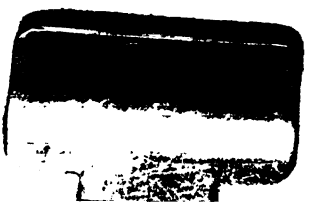
INDUSTRIAL WORK FOR BOYS

A. E. PICKARD

ELEMENTARY INDUSTRIAL SERIES



Industrial Work for Boys

BY

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PREFACE

For several reasons, industrial work should not be left for the high school grades exclusively. First, comparatively few reach the high school. Second, it is as necessary to have early training in this phase of education as in any other, if the student is to do his best in the advanced work of the high school. Again, experience proves that the industrial work offered in the grades creates interest and enjoyment in the pupils and is a means of retaining more pupils in school much longer than the average time of attendance in schools not offering such work. Finally, a study of the industries of a great commercial nation, such as ours, is of vital importance to the future welfare of the country, and cannot begin too early.

The work suggested in this little book has been done successfully for a number of years in the teachers' training department, in the intermediate and upper grades and in the rural schools that were under the supervision of the author. At the annual exhibit of fifteen associated rural schools practically all the work here outlined has been shown.

Any of the elementary work that the students already have had may be omitted. Boys who are taking the work for the first time, however, should do the work in weaving, both paper and rug, as well as basketry and other work before attempting the rope work and woodwork. The teacher should have several industrial books for reference, from which occasionally supplementary exercises may be given. The "Farm and Business Accounts" should be expanded and used as the basis for much of the work in

the upper arithmetic classes. A home credit plan should be adopted and the students encouraged to do some of the home projects during the school year as well as in the summer. Naturally, more can be done in some schools than in others, but all can do some industrial work; and, if the students are allowed some form of credit for what is done at home, most of this course can be completed. The teacher will find a discussion of the industrial course of study in the author's "Rural Education." Teachers who are not familiar with the Division Plan of conducting the classes should use that book as a reference.

Several persons materially assisted the author in the preparation of this book. Mr. J. B. Frear, formerly instructor in farm mechanics at the Minnesota College of Agriculture, kindly gave permission to use material from Minnesota Bulletin Number 136. The photographs of rope work were made especially for the author by Mr. J. T. Horton, station photographer, by special arrangement with the Minnesota College of Agriculture. Especial thanks are due Mr. A. H. Carlson, head of the Industrial Department, Rushford, Minnesota, and Mr. L. E. Stockwell, head of the Department of Manual Training, Cokato, Minnesota, for valuable assistance in the preparation of the projects in woodwork. Also to Supt. R. H. Blankenship, of Pine County, Minnesota, one of the pioneer advocates of industrial work in rural schools. State and federal bulletins as well as industrial periodicals were consulted for some of the projects given.

A. E. PICKARD.

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CHAPTER I

COURSE AND EQUIPMENT

It is hoped that the exercises in industrial work here given may be the means of causing some boys to "find themselves." As soon as the value of the work becomes recognized, the boys will appreciate it and will do the exercises with enthusiasm. No other kind of work is more useful or more elevating. Collateral information should be sought and given. For example, where do raffia and rattan grow and what are they used for in the industries? Where do twine and rope come from and how are they made? What kinds of woods in this country are used in manufacturing and what is the value of each kind for special purposes?

No young man is truly educated unless he knows something about the industries of his country. The suggestions here given should be carried out as fully as possible. The pupil will thus become much better informed than the mere "bookworm," and will realize that work with the hands is as honorable as work with the head.

The elementary work of the first few pages must not be underestimated. It is worth while, and the students who are best in it will nearly always become the most proficient in the rope and bench work. Mature college students often do this simple work and find it interesting and useful.

It should be planned to do as much of the "home project" work as possible. If the student is not fortunate

enough to have a shop at home, he can at least have a bench, which he himself can make. The bench can be housed in a shed or other building until a permanent shop can be fitted up.

PURPOSE OF INDUSTRIAL WORK

A noted educator says this of industrial work: "As far as it neglects industry, the school falls short of its purpose. Industry is among the departments of civilization about which everybody should know something. Social efficiency, too, depends upon knowledge; for without some acquaintance with industrial affairs even those who are engaged in other pursuits are handicapped. They cannot intelligently co-operate with work which they know nothing about."

Industrial training in the elementary schools has been too much of the hit-or-miss kind. There has been no standard course of study to follow, and resourceful teachers have been able to conduct the work only on account of their own training and interest in it. Only two extremes could be expected under such circumstances—talking about industrial work without doing it, and making unrelated articles without instruction.

The time given to industrial work must depend upon local circumstances. At least two hours a week should be devoted to it, and more if possible. The school should be divided into either two or three divisions for this work. The "Division Plan," discussed at length in "Rural Education," divides the usual eight grades into the First Division, the Second Division, and the Third Division. The First Division includes the first three grades; the Second Division includes grades four to six inclusive; and the Third Division is made up of the seventh and eighth

grades. Probably a better plan is to have but seven grades in the rural school curriculum. In that event, the Second Division will include only the fourth and fifth grades, and the Third Division, the sixth and seventh.

The supplies needed will naturally depend upon the size of the school and the time given to industrial work. From five to fifteen dollars' worth will be enough for the general industrial work. The industrial and sewing materials of the advanced division should be paid for by the students. A suggestive list of materials with prices is given. They may be purchased from a school supply house.

For the First Division, paper weaving materials are needed. These may be purchased in packages in various sizes, with slits one fourth, one third, and one half inch wide, at about a cent for each mat. All the standard colors may be obtained. Colored sheets should be purchased and

Figure 1. Preparing and assorting material for industrial work in rural associated schools.

strips cut with the scissors for more advanced weaving after the ready-made mats have been put together. Papers for folding and cutting may be purchased at fifteen to twenty cents a hundred squares, usually four by four inches.

Looms may be made or purchased. Hammock looms are easily made by cutting heavy cardboard to the desired size, rounding the ends, and cutting notches in them for the fastening of the warp. These are inexpensive and are just as good as those that are purchased. Looms for rug weaving may easily be made in the school, if the students have manual training. A loom that retails for thirty cents may be made for from three to six cents for the material. Use oak one fourth of an inch thick. Pine or basswood will do. The two endpieces are each ten inches long and one and one fourth inches wide. Place the two endpieces together side to side and make a series of cross notches from end to end by sawing their edges a quarter of an inch deep and a quarter of an inch apart. In these notches the warp is fastened for weaving. The ends are fastened apart with two sidepieces twelve inches long and three quarters of an inch wide. These are fastened by sawing a slit in the ends of the endpieces, so that the sidepieces will just fit flatwise. They are then nailed and glued. Holes are bored in the ends for the heavy wire to make the loom adjustable in width. These wires are copper, three sixteenths of an inch in diameter, and may be bought at any hardware store. They should be cut fourteen inches long and have a loop made in one end for a handle. A wooden crosspiece similar to one of the ends may be made to slide along the sidepieces. This will enable one to make the loom adjustable in length as well as in width. Flat wooden needles made from quarter-inch basswood, rounded off at one

end, and a hole bored in the other for threading the material, can be made very easily, and they are better than the metal needles for the most of the weaving. These should be sandpapered down until they are a little less than one eighth of an inch thick, a half inch wide and about ten inches long. With such a needle, the material may be drawn through the entire width of the rug at one time. Metal needles are needed for finishing the rugs and for working patterns. See Figure 7.

Rug materials are few or numerous as one desires. Colored rags from home are as good as anything for the practice work and cost nothing. They should be cut or torn into suitable lengths and widths. Roving is a very coarse weaving material, excellent for beginners, and may be purchased in colors at about seventy cents a pound. It should precede the finer materials. Carpet yarn may be obtained at about sixty cents a pound. Jute makes cheaper weaving material at from twenty-five to thirty cents a pound. Chenille, plain and mottled, is good for pattern work or for the entire rug. It costs about sixty cents a pound. Macrame cord comes in balls, any color, and costs about fifteen cents a ball. It is used principally for hammock making, but is rather expensive. For practice, rugs may be made out of rags, raffia, or even corn husks, and save the expensive materials for exhibit work. All these materials are used for the woof of rugs and hammocks. For the warp to "thread" the looms, carpet warp may be purchased in colors at about fifty cents a pound. Brass rings for hammocks will cost about two cents a pair for the inch size. Smaller ones may be used, if desired. Germantown yarn is beautiful for knitting caps, bonnets, mittens, leggings, etc., but is rather expensive for rugs. It costs about fifteen cents a skein.

Basketry and raffia supplies may be furnished by the school or purchased by the students, as desired. Plain raffia costs from fifteen to eighteen cents a pound, and colored, from forty to fifty cents. Rattan, or round reeds, will cost from thirty-five to eighty-five cents, depending upon the size. The medium sizes are used most, but the teacher should order by sending samples of the sizes desired. Flat reed for napkin rings and basketry costs about fifty cents a pound. Raffia and rattan may be dyed, if desired; but it is rather hard to get uniform tints unless one has had practice. The finished baskets and trays should be shellacked as soon as they are made.

Clay for modeling comes in three forms—the flour, in bricks, and moist in barrels. The flour may be obtained in five-pound boxes at five cents a pound. The bricks are usually five pounds each and cost the same as the flour. Moist clay is a little cheaper when purchased in barrel lots. Some communities have near at hand clay that is good for this work, and costs only the labor of getting it.

PRELIMINARY INDUSTRIAL WORK

Those pupils who have not had the industrial work of the lower grades should learn the principles of weaving some raffia and rattan work, and do a little modeling with clay. A few simple exercises are given, the material for which should be furnished by the school. The students should make the looms, using paper for the Germantown yarn and hammock work, and wood for the rugs. Have a brush and shellac for the baskets and trays.

Paper folding and construction may precede or follow the paper weaving. A ruler, pencil, pair of scissors and paste are needed. Make envelopes and boxes for seed and other collections in agriculture. Other objects from which

a selection may be made are as follows: Small basket, doll's furniture, sled, Indian canoe, Puritan cradle, shaving ball or pad, needlebook, match scratcher, Christmas bells, windmill, May basket, carriage, house, barn, chicken-coop, picture-frame, bookmark, fan, Chinese lantern, circular marker, hexagonal box, blotting-pad, calendar, valentine, button box, tent, card and photograph holders, screen, flower holder, whisk-broom holder and pocket comb holder. The materials for these are common manila drawing paper, oak tag, cover paper and colored construction papers.

Figure 2. Germantown yarn work, showing caps, sweaters and leggings.

Weaving is usually begun with paper strips and readymade mats, as given under materials for industrial work. Paper weaving may be followed by basket weaving with heavy folding paper, and by the weaving of bookmarks, pencil trays, mats, boxes, napkin rings, match safes, pincushions, blotters, calendars and thermometer backs. After paper weaving, loom work should be given. Rugs of rags, roving, yarn, jute, chenille, raffia and other materials are made. Bed blankets and draperies for a doll's house may be woven. Hammocks, made of macrame cord on homemade cardboard looms, may be hung outside the doll house. Doll caps, mittens, and leggings may be made of Germantown yarn on the loom and sewed to shape. See Figure 2.

Figure 3. Making rattan trays and baskets on the school grounds.

Raffia and rattan work should largely be done in the intermediate and advanced divisions. Raffia rugs, napkin rings, picture frames of cardboard wound in raffia, and raffia baskets may be attempted in the primary division.

Modeling is always of interest and its educational value is evident. A piece of oilcloth or a square board should protect the desk. When clay is used it should be prepared the day before. The children, of course, must be able to wash their hands after the work. Encourage outside work and ask the children to bring their products to school to show the others. Modeling is especially valuable in training both hands at the same time. Begin with forms from life, as animals and plants, rather than with geometrical forms. Later the latter should be given, and the ball, apple, peach, pear, orange, banana and other similar objects modeled. A bird's nest and eggs, marbles, clay baskets, beads and ornamental vases are some of the popular pieces. It is well to have in mind the following general divisions of the subject: 1. Modeling from objects present at the time. 2. Modeling from memory. 3. Modeling from

imagination. 4. Design in modeling. Fruit modeling may be shaded with water colors and, when dry, given a coat of shellac which gives a very natural effect, if well done. Other objects may be colored in a similar manner.

SECOND AND THIRD DIVISION WORK

The general industrial work of these divisions should be raffia and rattan weaving, basketry and rope work. The objects made may be varied. If manual training is given in these divisions, there will not be much time left. A little basketry, however, and rope work should be given sometime during the course. Napkin rings of rattan and flat reed, baskets of raffia and rattan, collar boxes of rattan wound and fastened with raffia, serving trays of rattan with a wooden bottom, wastebaskets of heavy rattan and knots and splices in rope work, are all useful and practical lessons. The rattan work should be given a coat of shellac as soon as finished.

Reference books are necessary for the best results in industrial work. It is impossible to give directions for making of many of the articles suggested here, as space will not permit. The authors have found the following list of books almost indispensable: Paper Sloyd for Primary Grades, by Rich; Industrial Work for Public Schools, by Holton and Rollins; Hand Loom Weaving by Todd; Cardboard Construction, by Trybom; Hand Work, by Hoxie; Raffia and Reed Weaving, by Knapp; Clay Modeling, by Holland; and How to Make Baskets, by White. Bulletins on industrial work may be obtained free from many of the agricultural colleges.

Industrial work and geography should be correlated to the extent that the students should know where all the materials used come from and how they are used in the

industries. Raffia is a light yellow material that is shredded off from the bark of a certain palm tree. Most of ours comes from the island of Madagascar. On account of its pliability and toughness, raffia is much used for industrial work and also for rope making in the industries. Rattan is a kind of a palm that grows in the East Indies. It is peculiar in that it sometimes reaches one thousand feet in length, and is supported by neighboring trees. It grows in various sizes, but is seldom more than an inch in diameter. There are very few branches, sometimes none for two or three hundred feet. The different species are very useful in their native countries for plaited work, rope making, etc. Rattan is twisted into ropes and used for purposes requiring great strength. In this country it is used for basketry, rustic furniture making, etc. Jute is made from the inner bark of a tall annual plant native to the East Indies, but now grown in several countries for commercial purposes. The fiber is used for making carpet, canvas and rope.

Directions for making a few forms of industrial work are given for those who have no other books, but as many reference books on industrial work as the school can afford should be in the library.

CHAPTER II

GENERAL INDUSTRIAL WORK

Students desiring to do industrial work out of school for "home credit" should consult with the teacher regarding objects to be made. Try to develop originality. The following are school exercises:

1—Single Paper Weaving

Materials: Manila drawing paper for practice. Later, use colored papers for a variety.

Directions: Use a square of any desired size from four to eight inches. Fold the bottom over to the top. With

Figure 4. Paper weaving. Note different designs.

a ruler and pencil make lines one half inch apart, beginning one inch from the left side and ending one inch from the right side. The lines should run to the folded edge of the paper, but end just one inch from the upper edge. With the scissors cut along the lines. Open the paper. It will then be cut into slits one half inch apart. Cut another piece of paper into strips one half inch wide and as long as the square just used. Weave the first strip over one and under the next strip in the square. Weave the second strip

in the same way except that you weave under where you wove over in the first strip. Continue until all the strips are woven. Other weaving may be done, using strips of any desired width and color, and working out various designs in the square. As stated elsewhere, these squares may be purchased all ready for weaving, if desired; but it is cheaper to make them, and the practice in ruling and cutting is also desirable. See Figure 4.

2—Paper Box

Materials: Drawing paper, ruler, pencil, scissors and paste.

Directions: Draw on a piece of paper a square just double the size you want your box to be. Fold over the lower edge on the upper, then the lower edge back on the crease, then the upper edge forward on the crease. Turn the paper half around and do the same. Open. You will now have sixteen squares. With the scissors cut the lower edge of the two top corner squares and the upper edge of the two bottom corner squares. Fold, so that the four middle squares form the bottom of the box. Paste the corner squares on the inside of the box. Another box may be made in the same manner and used as a cover. Heavier paper may be used for boxes to store seeds and other agricultural products.

3—Paper Basket

Materials: Same as for the paper box.

Directions: If a square basket is desired, it may be made the same as the box. Then paste the handle to it, letting the ends extend on the inside of the basket. A better form is an oblong about six by eight inches. Rule and cut a paper this size, being careful to get it exact. Fold it into two-inch squares, as directed for the box. Turn

the paper with the long side up and down. Cut the two sides of the upper middle square. Do the same for the lower middle square. Fold the corner squares over the middle squares and paste. Cut the handle and paste on the inside in the middle of the basket. After practicing with drawing paper, heavier material may be used for more permanent baskets. Two colors may be used, if desired.

4—Paper Table

Materials: Heavy folding paper, scissors and paste.

Directions: Cut a square twice the dimensions desired for the table. Fold it into sixteen squares, as directed in making the box. Cut along the bottom of the two upper corner squares and along the top of the lower corner squares. Fold the ends over the corner squares and paste securely. The bottom of the box just made is the top of the table. Cut out an oblong from each side beginning one half inch from the corners, making it about three inches long, to form the legs.

5—Paper Chair

Materials: Same as for the paper table.

Directions: Cut a square having about three fourths as many inches on a side as you used for the table. Fold this into nine squares, as directed in the first numbers. Cut along the top of the lower corner squares. Cut along both sides of the upper middle square. Fold the upper middle square toward you. This forms the back. Now fold one of the upper corner squares over the other and fold the rest of the squares to form a cube. Paste securely. Strengthen the back by pasting a paper of the same size over it. At the bottom cut out oblongs from each side to form the legs, as directed for the table. The back may be ornamented or left square.

6—Paper Lantern

Materials: Plain or colored folding paper, black paper, scissors and paste.

Directions: Paste half-inch bands of dark or black paper across the top and bottom of a six inch square of colored paper or paper tinted with water colors. Wall paper makes pretty lanterns. Fold the bottom over on the top edge. Cut half inch slits from the crease to the black paper. Form circles with the black edges, making the top and bottom of the lantern. Paste securely. Cut the handle of the same material as the circular strips, making it the same width and six inches long. Paste it to the lantern, and hang where the lantern will show to advantage. A cardboard bottom may be inserted, and a small candle fastened to it.

7—Jack-o'-lantern

Materials: Drawing paper and yellow construction paper, or tinted drawing paper.

Directions: Draw an oval the shape of a pumpkin about three by three and one half inches, leaving a short stem at the top. Cut out. With this, trace another on yellow or tinted paper. Cut this out. Then cut holes for the eyes, nose, and mouth, and paste the colored paper over the other. Black disks of paper may be pasted on the pupils of the eyes, and triangles for the teeth. These may be used for invitations or hung up for decorations.

8—Halloween Fence

Materials: Manila drawing paper and yellow tinted paper.

Directions: Using a piece of drawing paper eight inches long and two and one half inches wide, cut out quarter-inch oblongs three and one half inches long, leaving a quarter of an inch at each end to represent the post. Cut out five of these, leaving four strips of paper for the boards. Do

likewise on the other half of the paper. This will make three posts and four boards between each, with the posts projecting above and below. Paste the fence to a sheet of colored mounting paper. On the top of each post paste a small Jack-o'-lantern about one and a quarter inches in diameter. See Figure 5.

Figure 5. Halloween fence, paper cutting and mounting.

9—Christmas Bell

Materials: Red construction paper about the weight of light oak tag, pencil and scissors.

Directions: On a five-inch square draw or trace a bell, having the widest part at the bottom, the width of the square. A rounded projection in the middle at the bottom represents tongue, or clapper, of the bell. Cut along the outline. A small hole punched in the top of the dome will enable one to hang the bell. It may be used to send an invitation to a school entertainment.

10—Christmas Stocking

Materials: Same as for number seven.

Directions: On a piece of red construction paper draw or trace a stocking about eight inches long and three inches wide at the top, and foot. Cut along the line. This may also be used to send an invitation or to hang up for Christmas decoration.

11—Santa Claus

Materials: Red cardboard, cotton and metal fasteners.

Directions: Trace the upper part of the body down as far as the waist line, making this part about five inches from the top of the head to the waist, and about three inches across at the waist. Cut out. Cut the arms and fasten with a brass fastener, one on each side of the body. Cut out the lower limbs about four inches long and fasten

Figure 6. Santa Claus at Christmas.

on the under side of the waist line. Both the arms and legs will then be movable. Paste cotton on the head for hair and whiskers; on the hands for fur mittens; on the waist line of the coat and above the ankles for the tops of the leggings. This makes an interesting Christmas decoration.

12—Roving or Yarn Rug

Materials: Loom and needle, carpet yarn or string for warp, and rags, yarn, chenille, raffia or roving, for the woof.

Directions: Thread the warp back and forth through the notches at the ends of the loom. See that it is as tight as possible. Weave the woof over one strand of the warp and under the next, across the rug. Return, going under the strand you went over before, and over the next, and so on. If a long wooden needle is used, it may be

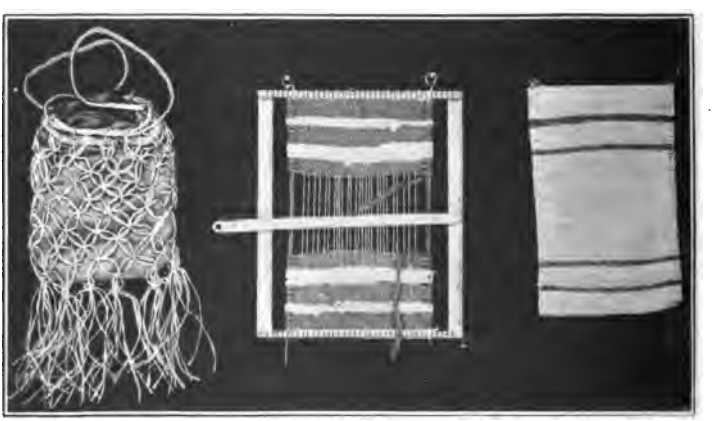

Figure 7. Raffia bag, yarn mat on a homemade loom and a raffia mat.

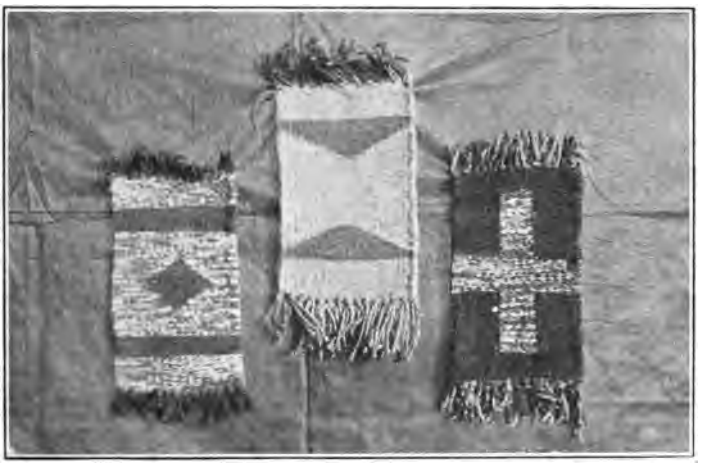

Figure 8. Roving and chenille rugs.

drawn across the entire mat at once, thus saving time. Colored borders and stripes may be used or designs worked in. The loom can be adjusted to any size of material. In a previous paragraph, see directions for making a home-made loom. Keep the woof tight by packing it with the needle and finger. When finished, remove and bind the ends of the warp with carpet yarn, or make a fringe. Raffia may be used instead of roving or yarn. See Figures 7 and 8.

13—Hammock

Materials: Cardboard loom, macrame cord in two colors, a large darning needle and two brass rings about three fourths of an inch in diameter.

Directions: Fasten the warp into the rings which are attached to one side of the loom, and wind it around the ends of the loom over the notches, or through the holes, if those are used instead of notches. Any number of warp

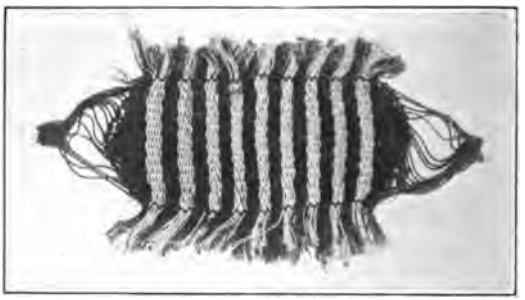

Figure 9. A hammock made of macrame cord.

strands may be used, from sixteen to twenty being common. After the warp is stretched tightly, begin the weaving with the same material used for warp. The woof strands should be about half as long as the distance between the two rings after the hammock is removed. Colored stripes may alternate or borders may be used. When finished, remove from the loom and make a fringe.

14—Reed Napkin Ring

Materials: Wooden loom, number three or four rattan, number one rattan, flat reed and a knife.

Directions: Make a small wooden base of basswood or pine two and one half inches square and a quarter of an inch thick. On this base draw a circle two inches in diameter. With the ruler find the perpendicular diameter, and place a dot at each end of it on the circle. Do the same for the horizontal diameter. Again divide the space between the dots into three equal parts, until you have twelve dots on the circle, the same distance apart. With a brace and bit, or gimlet, bore holes through the base at the dots. These should be a trifle larger than the size of rattan you want to use for the frame of the napkin ring. Cut twelve

pieces of rattan about the size of a match and one and one half inches long. Place these firmly in the holes of the base. Using rattan a size smaller as a weaver, weave four times around the base, going inside of one upright and outside the next. The second time around weave opposite to the first time, and alternate each time. The weaver is moistened so it is tough and pliable. Pull it tight, and press firmly against the base. Next use flat reed for two layers and weave in the same way. Then weave four rounds more of the same size rattan as on the bottom. Fasten the last end securely. Pull the ring off the base, being careful not to leave any of the uprights in it. With number one rattan, bind the edge together firmly by fastening one end around the top of an upright, crossing to the next lower end, twisting around this end, crossing to the next upper end, and so on, until you have gone around the ring twice and finished binding each upright. Cut off the ends of the uprights. Your napkin ring should be strong and somewhat resemble a snare drum on the outside. Be sure to keep the material moist while working. See Figure 10.

15—Raffia Picture Frame

Materials: Cardboard and raffia.

Directions: Cut out a circle from the cardboard. It may be any desired size, but about six inches in diameter is common. Cut another circle in the center, leaving a hole in the middle about two and one half inches in diameter. Select board, smooth raffia. Moisten it, and wind carefully around from center to outside. When finished, sew a braid of raffia around the outer edge, making a loop at the top by means of which to hang it up. Put in the picture. Oval or square shape frames may be made according to the individual preference.

16—Rattan Mat

Materials: Number three rattan for spokes, raffia and number one rattan for weaving.

Directions: For a six-inch mat you will need to use pieces of rattan fourteen inches long in order to make the border and fasten the ends. Cut eight pieces of the number three rattan fourteen inches and one piece eight inches, as it is easier to weave with an odd number of spokes. Take four of the long spokes and cut a slit one half inch long exactly in the middle of each. Draw the other four long spokes half way through these slits, making a cross. Put in the short spoke until the end shows on the other side. With a needle weave raffia over one and under the next spoke, starting in the center, until you have woven a little circular mat about an inch all the way round from the center, or two inches in diameter. You will thus make a firmer middle than you can usually get with the rattan. Now use number

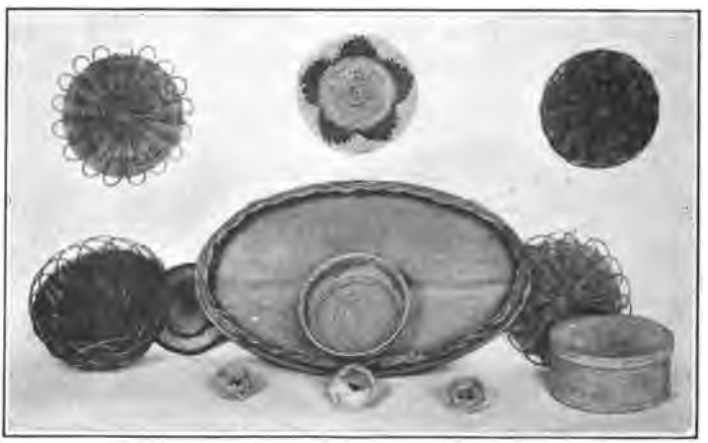

Figure 10. Rattan and raffia work, showing serving tray, baskets, collar box, mats and napkin rings.

one rattan for the weaver in the same way, and keep the seventeen spokes the same distance apart, until you have a mat about six inches in diameter. Now sharpen the ends of the spokes, moisten them so they will bend easily, and pass each one in front of the next spoke to the left, and push it down beside the second spoke, thus making a loop about two inches across and an inch high. Do this with each spoke until the border is finished. While the mat is moist, see that it lies perfectly flat. When dry, put on a coat of clear or colored shellac. See Figure 10.

17—Rattan Basket

Materials: Number four and number two rattan, and plain raffia.

Directions: Cut eight pieces of number four rattan from eighteen to twenty-four inches long, depending upon the height of the basket desired, twenty inches being a good length. Cut one piece an inch or two more than half this length for the odd spoke. Proceed as for the mat in number 16, using the raffia center, until you have a four-inch bottom. Moisten the spokes, and turn each one up as you pass the weaver around it. Keep the weaving pressed down firmly, the spokes the same distance apart, and be very careful in shaping your basket, that it may be even all the way around. When through weaving, fasten the end securely. Make a border with the spokes as for the mat, only pass the spoke to the left in front of two spokes instead of one, and push it down beside the third. This will strengthen the top. Be sure the shape is good. Let dry. Shellac, natural or colored. See Figure 10.

18—Raffia and Rattan Mat

Materials: Number two or three rattan, raffia, needle.

Directions: Moisten the rattan and begin a coil. Take a needle full of raffia. Wind the end of the coil for a short

distance and fasten it together in a ring as small as you can draw it. Continue coiling the rattan, and winding it with raffia. Wind from you. About every third wind, pass the needle between the ring formed and the next coil of rattan, thus fastening the rattan to the ring. The third coil is fastened to the second in the same manner and so on until the mat is completed to any desired size. Colors may be used for as many coils as you wish, making borders. This makes a soft durable mat.

19—Collar Box

Materials: Same as for number eighteen.

Directions: Make the bottom six inches in diameter, the same as the mat was made. Then turn the coils up to form the circular side of the box. If two pieces of number two or three rattan are wound together instead of one piece, the effect is more pleasing, and you will have a firmer box. Continue the coils until the box is three inches deep. Now make a cover in the same manner as the bottom was made, turning the edges up half an inch, so they will fit down over the box, when inverted for the cover. This may be fastened on, if desired. See Figure 10.

20—Wastebasket

Materials: A circular base of one half an inch of pine or basswood nine inches in diameter, heavy rattan for spokes, number seven or eight, and rattan about two sizes smaller for weaving.

Directions: Drill a row of twenty-five holes one half an inch from the edge of the wooden base. Cut twenty-five spokes of heavy rattan about two feet long, and put them through the holes so that they extend about three fourths of an inch below. Using rattan about two sizes smaller as a weaver, turn the bottom side up, and weave

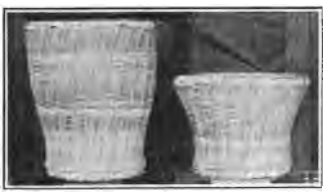

Figure 11. Rattan wastebaskets.

six or eight rows around the spokes, as in basket weaving. Then fasten the ends of the spokes securely, making a close border. Now turn the bottom over, and press the board down firmly on the rattan base. Begin to weave above the board, keeping the twenty-five spokes the same distance apart, and shaping the basket as you proceed. Make to any desired height, usually about a foot, and fasten the top of the spokes as for the mats and baskets. Cut off ends of spokes. Colored rattan will make effective designs. Finish with shellac. See Figure 11.

21—Serving Tray

Materials: Wooden base, pine or basswood and rattan.

Directions: Make a wooden base of half-inch material in an oval about fifteen inches long and ten inches at the widest part. Bore holes for heavy rattan as for the basket. Make the spokes long enough to weave and fasten below and to make the tray about two inches deep with a close border on top. Weave with number five or six rattan and

Figure 12. Clay work, showing fruit and geometrical forms.

use number seven or eight for the spokes. This makes a very firm and useful tray. It should have two coats of shellac for finish, either dark or natural. See Figure 10.

22—Clay Modeling

Materials: Clay, oilcloth, water colors and shellac.

Directions: Prepare the clay the day before it is to be used. Do not have it too wet, just moist enough to work well. Knead until oily. Mould into shape of object being modeled. If fruit, tint with water colors. Let dry. Shellac with natural finish. See Figure 12.

CHAPTER III

ROPE WORK AND BELT LACING

Rope is used so much on the farm that every boy should know at least how to take care of it, make a splice and tie the most common knots. Rope is made from the fibers of several different plants, as manila, sisal and common hemp, flax, cotton, jute and cocoanut fiber. These fibers are twisted in yarns, the yarns are twisted the opposite direction into strands and the strands twisted in the same direction as the fibers into rope. The opposite twisting keeps the rope from untwisting. See Figure 13.

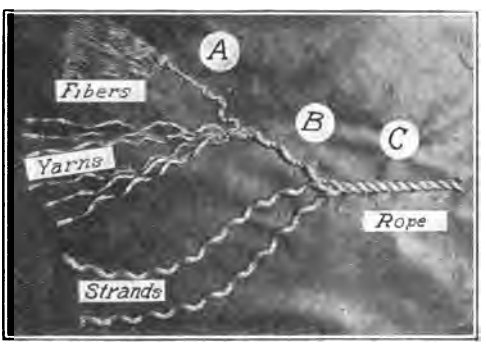

Figure 13. The construction of rope. The fibers are woven into yarns, the yarns into strands and the strands into rope.

The strength of rope depends upon the quality of the fiber, the number of strands, the workmanship and the kind of preservative on the

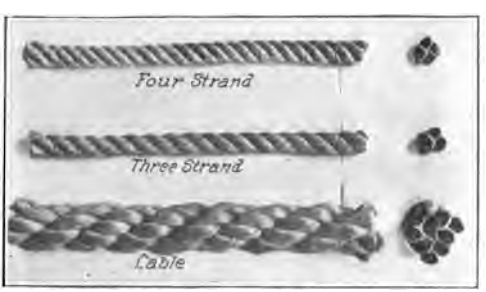

Figure 14. Strands are twisted "left-hand" to form rope and the ropes are twisted "right-hand" to form a cable.

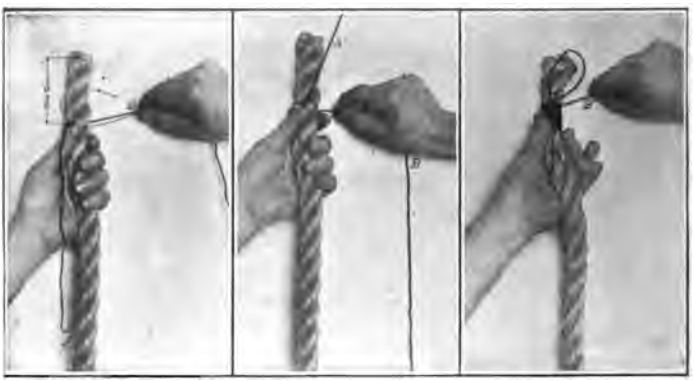

Figure 15. Whipping, or wrapping, the end of a rope, showing the first three steps in the process.

fiber. The strength naturally decreases with age, wear and exposure. A safe load must be much less than the breaking strength, and for old ropes it must be a matter of good judgment. Rope should be kept in a dry place. If it gets wet, it must be stretched out straight to dry. A hardened rope may be made pliable again by boiling in soft water.

"Whipping" is used to prevent the ends from untwisting. This is done by putting a string under a strand of the rope about three inches from the end and allowing one end to hang loose. Wrap the other end of the string

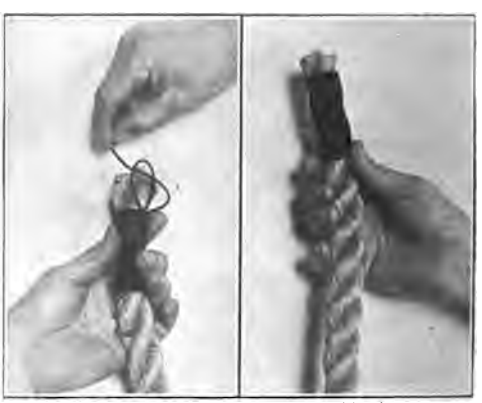

Figure 16. The final steps in whipping.

once around the rope, and then fold the loose end over. Continue wrapping the string tightly around the rope and string until you have wrapped about half way to the end of the rope. Fold the loose end back to form a loop that extends a little beyond the end of the rope. Wrap the string around the rope and loop, and pull the other end until it draws the string under the whipping as far as possible. See Figures 15 and 16 showing the operation.

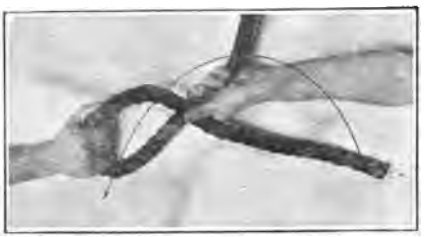

Figure 17. Forming the "bight," or loop, for a figure eight knot.

The figure eight knot is used for preventing the strands from untwisting, and for forming a handhold at the end of the rope or at any point between the ends. In making it, form a bight as shown in Figure 17, then move the end as shown by the arrow in Figure 17 until it is in the position shown in Figure 18. Draw it up tight.

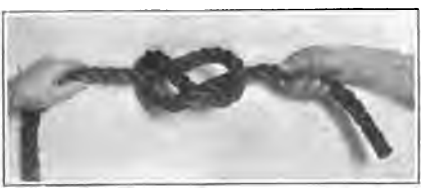

Figure 18. The completed figure eight knot.

The overhand knot is used for the same purpose as the figure eight knot and is made by forming a

Figure 19. The overhand knot before drawing tight.

bight through which the end of the rope is passed. The loose knot is shown in Figure 19.

The square knot is used for tying rope securely together. The knot may be tied by studying the illustrations. Cross the ropes as shown in Figure 20. Move end B as shown by the arrow until it is in the position shown in Figure 21. Move ends A and B as shown by the arrows until they are in the position shown in Figure 22. Be sure the proper end is nearest you at the point of crossing in the right hand. Move end B, as shown by the arrow, until it is in the position shown in Figure 23, and draw up tight as shown in Figure 24. Both parts of one rope should be in front of or behind the other, as shown at points C and D in

Figure 20. Crossing the ropes to tie a square knot.

Figure 21. The second step.

Figure 22. Forming a loop by crossing ends A and B.

Figure 23, not as shown at points E and F of the granny knot in Figure 25.

The granny knot shown in Figure 25, is of very little use and tends to slip under a pull. It is tied only by those who do not know the difference between it and the square knot.

The bread box knot shown in Figure 26, looks very much like the square knot, but it is likely to slip. The difference in the finished knot is in the positions of the ends A and B, as can be seen in comparing Figures 23 and 26.

Figure 23. End B brought under to complete the knot.

Figure 24. Pulling the square knot tight.

The slip knot is used when a loop is wanted that will slip up tight around an object. There are four steps in tying it. Hold the rope as shown in Figure 27. Move the right hand so that point A moves as shown by the arrow in Figure 27, thus forming a round turn in the left hand as shown in Figure 28, and allow the right

Figure 25. The granny knot. A poor knot. Note the difference between it and the square knot.

hand to slip on the rope to point B. Move the right hand so that point B moves, as shown by the arrow, to the position shown in Figure 29. Draw the overhand knot that has been formed up tight and the finished knot should appear as shown in Figure 30.

The slip knot and half hitch make a combination that form a permanent loop that will not slip. Tie a slip knot by the method shown in Figures 27 to 30, except that you start with the short end held in the right hand and the long part in the left hand. The slip knot is shown in Figure 31. Move end A as shown by the arrow. A half hitch is thus made around the long end as shown in Figure 32. Complete the knot by drawing up tight as shown in Figure 33.

Figure 26. The bread box knot. Similar to the square knot but likely to slip.

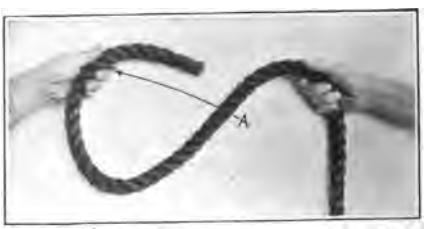

Figure 27. Starting the slip knot.

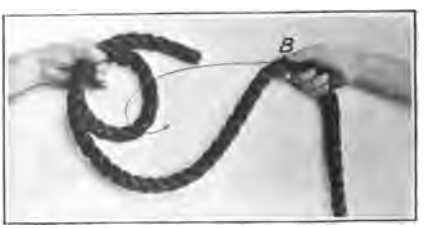

Figure 28. The second step.

The double bowline is used when a loop is wanted between the ends of a rope that will not pull tight or slip. It is tied as follows: Grasp

the rope as shown in Figure 34. Tie an overhand knot as shown in Figure 35. Fold loop A back over the overhand knot as shown by the arrow, and then grasp the knot with the left hand exactly at point B as shown in Figures 35 and 36. Hold the double bight securely in the left hand and draw that part of the rope which forms loop A through the double bight, as shown by the arrow in Figure 37. This knot may be tied through a loose ring.

Figure 29. The point B in figure 28 has been passed through the loop.

Figure 30. The finished slip knot.

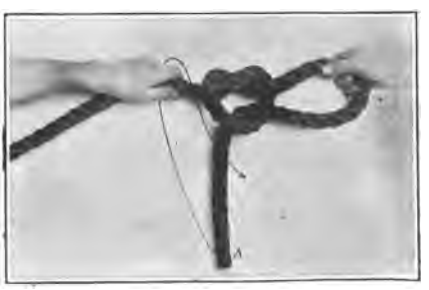

Figure 31. Beginning the slip knot and half hitch.

The block and tackle is used for lifting heavy loads. The more ropes in the "tackle," the greater the weight that can be lifted with a given power. Figures 38 and 39 show how to thread double and triple blocks. The part of the rope to which the power is applied is called the fall rope, and the block from which it passes is called the fall block. The fall block in Figure 39 is a triple block. The others shown are

double blocks. Passing the rope through the blocks in the proper way for use is called reeving. One of the blocks always has a becket, or projection, to which the rope is fastened. In reeving blocks it is best to pass the rope through the blocks in the opposite direction to that in which it runs when the blocks are in action. This saves pulling all the rope through the block. Fasten the rope to the becket and pass it over the sheave farthest from the becket and around the pulleys in each block as shown in the illustration.

Figure 32. The half hitch added.

Figure 33. Completed by drawing up tight.

Figure 34. Starting the bowline knot.

Figure 38. Simple "block and tackle."

Common wooden blocks with iron sheaves are used for all ordinary work. For very heavy work, such as stump pulling, special blocks with heavy hooks and straps may be obtained. In ordering, the size of the rope to be used, the number of sheaves, and whether a becket is desired should be explicitly stated.

For heavy work, such as stump pulling and bridge work, blocks may be had with extra heavy hooks and straps and these also are equipped with roller bearings for the sheaves.

Figure 39. Showing another form of block.

Figure 35. The second step, or overhand knot.

Figure 36. Loop A folded back as shown by arrow in figure 35.

Figure 37. The final step of the bowline knot.

Steel blocks may be had, as, also, blocks of different construction for wire rope.

All blocks and rope must receive the very best of care. Otherwise their efficiency will be considerably impaired, involving the possibility of both loss and danger.

SUPPLEMENTARY ROPE WORK.

Crowning, or making a spliced end on a rope, is often desirable. It is used on the end of a halter rope or on any rope to stiffen the end and prevent its unraveling. To begin, unlay the strands about seven inches back from the end. Bend one strand over between the other two. The second is bent over the end of the first, and the third over the end of the second and under the loop, or bight, of the first. Draw the three strands down tight. Splice back each strand separately by putting it over the nearest strand in the rope and under the next strand. Pull each very tight.

The short splice is made in more than one way. A good method with three-strand rope is as follows: Unlay the ends to be spliced back about ten inches. Bring the two ends together so that each strand of one rope lies between two strands from the opposite rope. Tie each pair of strands together with a square knot and pull the knots tight. Work back each strand over one and under the next strand of the main rope, the same as in crowning. This splice is used where the size of the rope makes no difference.

The long splice must be used in a rope that is to run through a pulley or for any purpose where the size of the rope must not be increased. Untwist about two feet of the ends of the two ropes to be spliced. Perhaps the most simple method is to unlay one strand at a time and work that back first. Bring the ends of the two main ropes together at the

point where you ceased unraveling. Twist the strand of one rope into the groove previously occupied by the strand of the other. As fast as a strand is unlaid on one rope follow it up with the corresponding strand on the other. Continue until about six inches of each strand is left. Then tie each two strands with the first half of a square knot and pull tight. Continue to pass each of these strands around the other for two or three turns, leaving out a little of each strand each time after the second turn, so as to taper to a point. Cut off the ends.

Rope halters are very useful. They are especially good for getting young colts used to halters. They are easily made from half-inch rope and cost much less than leather ones. Crown an end of a rope about fifteen feet long. Allowing about six inches of the other end for splicing, measure off enough rope to go over the head of the animal for which the halter is to be made. A few inches from this point on the long end of the rope raise a strand and run the short end through and form an eye. Three or four inches farther along on this end of the rope raise another strand and put the short end through again, in the opposite direction, forming another loop. From this last loop measure off enough rope for the nose piece, raise a strand and run the short end through for about six inches. Separate the strands of the six-inch piece of rope and splice one into the

Figure 40. Rope halter.

piece that goes over the head, one into the nose piece and one into the main rope. Run the crowned end of the rope through the first loop formed and tie with a knot.

The student should have a copy of a bulletin on rope from the state agricultural college or Farmers' Bulletin Number 638. These give explicit directions and photographs of the different stages of rope splicing.

BELT LACING

Belt lacing has become a necessity on the modern farm. Every boy should know how to do it. A kind of lacing that would be satisfactory for a three-inch belt would not do for a six-inch belt. The hair, or grain, side of a leather belt goes next to the wheel or pulley. Strips of good, tough leather should be kept on hand where machinery is run by belting. As leather is rather expensive for practice in belt lacing in school, stiff cardboard may be used instead. A width may be cut to correspond with the width of the belt. Each student should prepare two pieces of cardboard the same width. Common widths are three inches and six inches. Make each piece of cardboard a little longer than it is wide. One side should be marked "grain side" to represent that side of the leather. Common binding twine may be used for the laces. If a belt punch is not available, the holes may be made with an awl. They should be just large enough to allow the twine to pass through twice.

There are several good methods of lacing. The two here described are given in Farmers' Bulletin Number 638. The holes in the cardboard, or leather, if it is available, should be made to correspond with those in the illustrations. The lace must be kept pulled tight constantly.

Lacing for Three-inch Belt.

Punch the holes as shown in Figure 41. The grain, or hair, side of both pieces of cardboard representing the ends of the belt should be kept down. Pass one end of the lace down through S and up through the opening M. This opening should be made with an awl and in such a manner that it will not be round, as the friction from an irregular hole will be greater and the lace will not slip. The other end of the lace should be passed through the holes in the order here given: V, R, V, R, T, S, Y, X, Y, X, T, S, T, U. Always keep the lace tight. If an awl is not available for making the openings M and U, a small nail may be used, as there is but one thickness of lace to pass through. Cut off the ends of the lace and nick them so that the lace will not slip. Study Figure 41, and do this lacing until you know how to lace the belt without reference to the illustration.

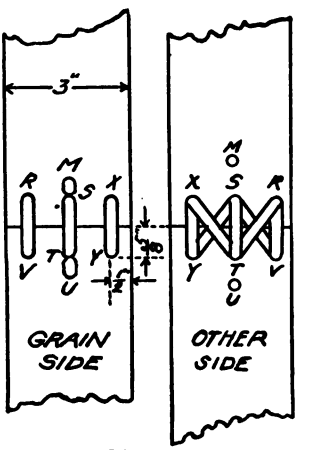

Figure 41. Three-inch belt laced.

Lacing for Six-inch Belt.

Punch the holes as shown in Figure 42. With the grain side down, pass one

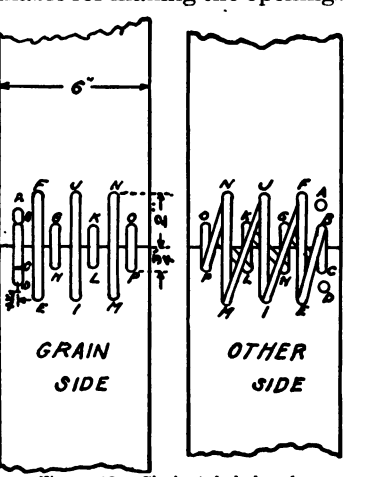

Figure 42. Six-inch belt laced.

end of the lace through the hole C and up through hole D, the latter being made smaller than the others. Pass the other end of the lace through the holes shown in the cut in the following order: B, C, G, H, G, H, K, L, K, L, O, P, O, P, N, M, N, M, J, I, J, I, F, E, F, E, B, C, B, and then through A, the other small hole made. Fasten the lace. Cut off the ends and nick them, thus preventing the lace from coming loose. This method will be found rather simple if the directions are followed carefully and practiced often enough to do the lacing without referring to the figures.

After these methods have been mastered, work out some original designs.

REFERENCES

Agricultural Engineering by Davidson; Knots, Splices and Rope Work by A. H. Verrill; Knots, Hitches and Splices by H. W. Riley; Knotting and Splicing Ropes and Cordage by Paul N. Hasluck; Kent's Mechanical Engineer's Pocket Book; The Blue Book of Rope Transmission; Rope and Its Use on the Farm by J. B. Frear (Minnesota Agricultural Experiment Station Bulletin 136) and Rural School Agriculture Bulletin No. 1, Minnesota Agricultural Experiment Station.

CHAPTER IV

WOODWORK AT SCHOOL

Requisites to the success of manual training in the school might be summed up under a few heads, as follows: Encouragement, a workbench, a few simple and inexpensive tools, some lumber and other supplies, definite time for the work each week, some simple working drawings, and an enthusiastic teacher to direct the work.

A workbench can probably be made by the students themselves with a little help from the teacher or from some man in the community who is "handy" with tools. If better material is not available, it may be made of pine, but should be strong and durable.

The tools needed are a try-square, hammer, backsaw, a few coping saws, plane, dividers, chisel, a ruler for each student, a brace and a set of bits, wood file, screw driver, crosscut saw and a file and saw set for keeping the saws in shape. Students can bring tools enough from home to start.

It is well to have on hand a little more lumber than is actually needed for each article. The following kinds of lumber will be needed: Basswood, one fourth inch thick, and three eighths inch thick; pine, three eighths inch thick, one half inch thick, three eighths inch thick, one and one half inches thick, and one and three fourths inches thick; oak, one half inch thick, one inch thick, one and one half inches thick. By referring to the drawings and the material for each project, it will be seen what the dimensions are. If it is impossible to get the exact thickness wanted, get the nearest to it.

A few sheets of fine, medium and coarse sandpaper should be kept on hand. The coarse should be used first, and the finest for getting the smooth surface. A bottle of shellac, a small brush and a can or two of stain will complete the equipment needed.

Working drawings are necessary for accurate work. Those given here are simple, and can be easily understood. They should be studied very carefully before attempting to make the articles. Upon the ability to read the drawings and directions well will largely depend the success of the project.

The student should study from reference books the use of each tool used and how to take care of it and keep it sharp. He ought also to know where each kind of wood used grows, how it is manufactured and why it is used instead of some other kind of material. The same information should be obtained for all other materials used.

The student should study each cut of the article to be made very carefully before attempting to do the work. Read directions and consult the cut again before starting.

1—Key Label

Material: Basswood as follows: 4 inches by 1¼ inches by ¼ inch.

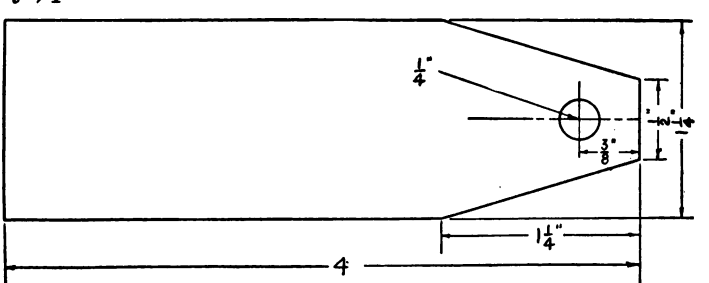

Figure 43. Key label.

Tools Used: Chisel, saw, brace, bit and ruler.

Directions: Saw out the stock 4 inches long and 1¼ inches wide. Then lay out the key label following the dimensions given in the cut. Chisel the edges carefully down to the line. Bore the hole.

2—Match Scratcher

Material: Basswood as follows: 3⅜ inches by 2½ inches by ¼ inch. Sandpaper.

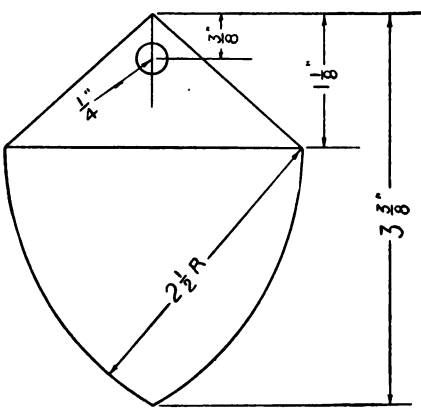

Figure 44. Match scratcher.

Tools Used: Chisel, saw, dividers, brace, bit and sandpaper.

Directions: Saw out the stock 3⅜ inches long and 2½ inches wide. Lay out match scratcher according to directions in the cut, using the dividers to make the arcs. Chisel to the proper shape and bore the hole. Cut out. Sandpaper till smooth. Fit the sandpaper and fasten on with glue. This is a useful article and will make a nice little remembrance.

3—Fishline Winder

Material: Basswood as follows: 6 inches by 2¾ inches by ¼ inch.

Tools Used: Chisel, saw, knife and ruler.

Directions: Saw out the stock 6 inches long and 2¾ inches wide. Lay out the fishline winder, following directions given in the cut. Chisel the sides to shape. With a

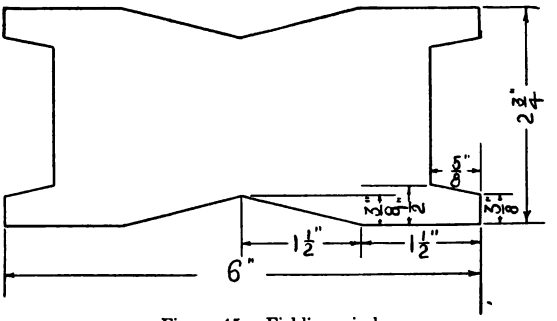

Figure 45. Fishline winder.

sloyd knife or jackknife whittle out the ends to the proper shape. Every boy will find a use for this article.

4—Plant Marker

Material: Basswood as follows: one piece 4½ inches by 2½ inches by ¼ inch; one piece 6½ inches by 1¼ inches by ½ inch.

Tools Used: Chisel, saw, dividers, knife and hammer.

Directions: Saw out the stock one piece 4½ inches by 2½ inches and one piece 6½ inches by 1¼ inches. Lay out the face of the plant marker; then lay out the stake. Using the knife, whittle out the face. Chisel out the stake. Nail the two pieces together. The

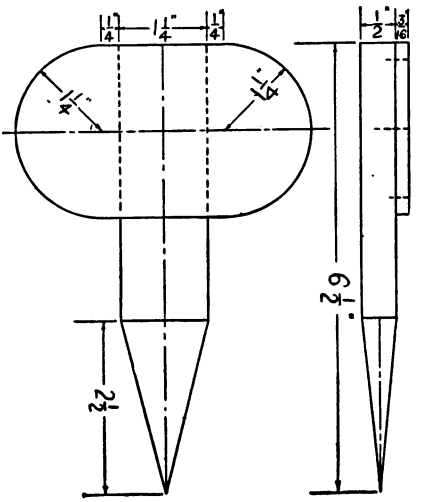

Figure 46. Plant marker.

plant marker will be found very useful in the spring when the vegetable garden is being made.

5—Window Prop

Material: Pine as follows: one piece ¾ inch by 4 inches by 11 inches.

Tools Used: Saw, plane, square and chisel.

Directions: Plane stock to given dimensions. Lay out steps. Saw and chisel to size.

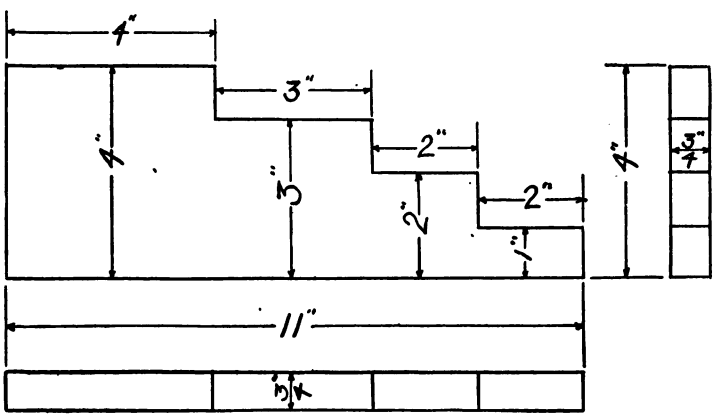

Figure 47. Window prop.

6—Soil Tube

Material: Pine or basswood as follows: two pieces ⅜ inch by 2½ inches by 4 feet; one piece ⅜ inch by 2 inches by 4 feet; two pieces ⅜ inch by ⅝ inch by 4 feet; two pieces ¼ inch by ⅜ inch by 4 feet; one piece ⅜ inch by 2 inches by 2⅛ inches. Glass for front 2 inches wide and 4 feet long.

Tools Used: Saw, hammer, plane and marking gauge.

Directions: Plane back, sides and bottom to dimensions. Nail the two sides to the back and back and two sides to bottom. Round off the ¼-inch by ⅜-inch strips

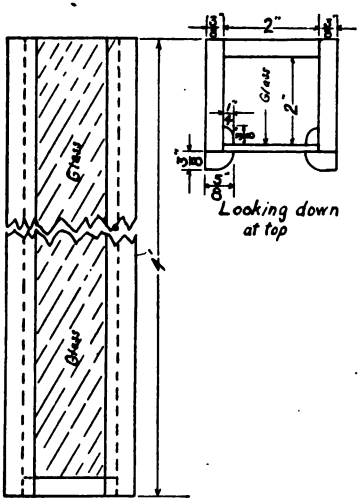

Figure 48. Soil tube.

on one edge and fit in from front edge ⅛ inch and nail them in place. Round off one edge of ⅜-inch by ⅝-inch strips and nail to front of tube, as shown. Sandpaper.

7—Bill File

Material: Pine as follows: one piece ¾ inch by 2½ inches by 10 inches. Two 10-penny finishing nails.

Tools Used: Saw, hammer, marking gauge, brace and bit.

Directions: Plane stock until smooth. Lay out bevels. Cut and plane. Bore small hole for nails. Drive nails through from back at 30-degree angle, and sandpaper until smooth.

8—Bracket

Material: Basswood or pine as follows: one piece ¼ inch by 5 inches by 5½ inches; one piece ¼ inch by 3 inches by 6 inches; one piece ¼ inch by 2½ inches by 5 inches.

Tools Used: Plane, saw, dividers, scroll saw and hammer.

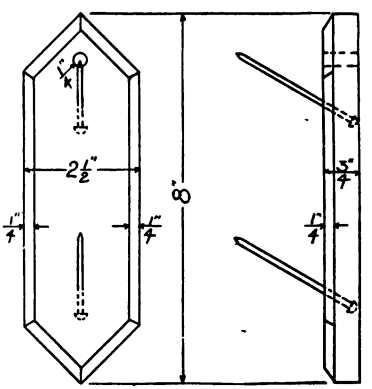

Figure 49. Bill file.

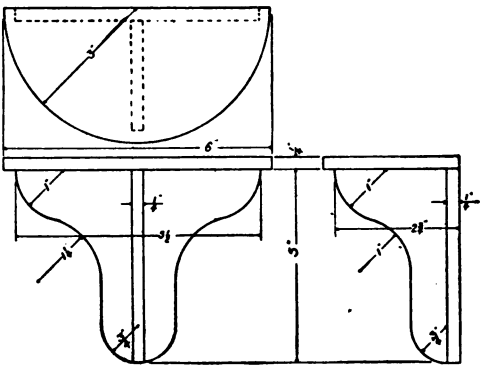

Figure 50. Bracket.

Directions: Saw out stock and plane to thickness. Lay out top, back and bracket, as shown. Cut to line, using scroll saw. Glue and nail together. Sandpaper until smooth.

9—Newspaper Holder

Material: Pine, basswood or oak as follows: one piece $\frac{3}{8}$ inch by $10\frac{3}{4}$ inches by 14 inches; one piece $\frac{3}{8}$ inch by $10\frac{3}{4}$ inches by 10 inches; two pieces $\frac{3}{8}$ inch by 2 inches by 10 inches; one piece $\frac{3}{8}$ inch by 2 inches by 10 inches.

Tools Used: Saw, plane, square, dividers, brace, bit, scroll saw, marking gauge and chisel.

Directions: Study drawing. Saw out stock and plane it to given dimensions. Lay out back and saw two upper corners. Glue, nail together and sandpaper until smooth.

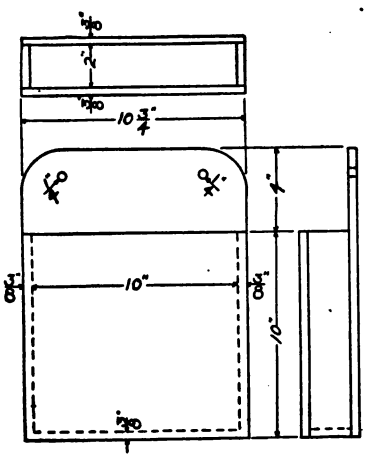

Figure 51. Newspaper holder.

10—Planing Exercise

Material: Pine $9\frac{1}{4}$ inches by $1\frac{3}{4}$ inches by $1\frac{3}{4}$ inches.

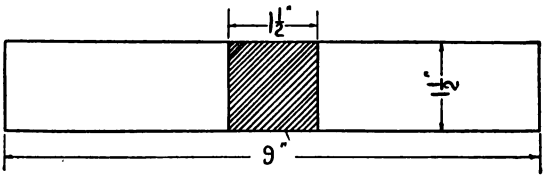

Figure 52. Planing exercise.

Tools Used: Plane and saw.

Directions: Plane and square a face. Test it with try-square. From this face square an edge. Next square one end with the squared face and edge. Cut to length and square end. Cut to width and square edge. Cut to thickness and square face. While the plane is necessary in making the objects listed above, it is not necessary to make up a planing exercise until more complicated projects are executed. If students do not get this exercise well the first time, it should be repeated, as they will need to be able to plane to the line in making the exercises that follow.

11—Sawing Exercise

Material: Pine 9¼ inches by 1¾ inches by 1¾ inches.

Tools Used: Plane and saw.

Directions: Plane and square up the stock to 9 inches and 1½ inches square. Study the drawing and make saw

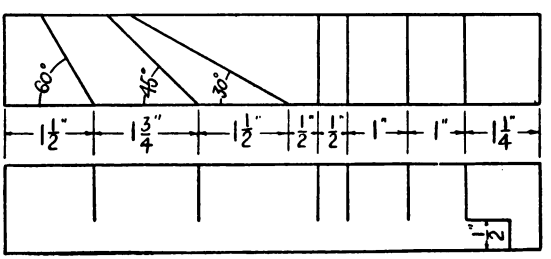

Figure 53. Sawing exercise.

cuts as designated in the drawing, using the backsaw. This exercise is also very necessary in order to do accurately the work that follows.

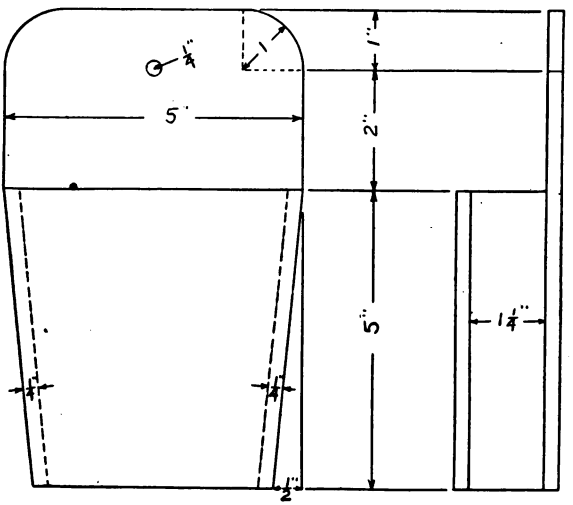

Figure 54. Whisk broom holder I.

12—Whisk Broom Holder I

Material: Basswood as follows: one piece 8 inches by 5 inches by ¼ inch; one piece 5 inches by 5 inches by ¼ inch; two pieces 5 inches by 1¼ inches by ¼ inch.

Tools Used: Saw, plane, brace, bit and hammer.

Directions: Saw out the stock according to directions. Lay out the back, front and sidepieces. Plane the back, front and sidepieces to the proper size. Then put the parts together. Bore the hole to hang the holder. This is a useful little article for the kitchen or bedroom.

13—Whisk Broom Holder II

Material: Basswood as follows: one piece ¼ inch by 8 inches by 8 inches; two pieces ¼ inch by 1⅜ inches by 7½ inches; three pieces ¼ inch by 1 inch by 5½ inches.

Tools Used: Saw, plane, hammer, bit and brace.

Directions: Saw stock to given dimensions. Lay out bevel on back and plane. Place side-pieces upon back, following dimensions. Mark off where bevel of the back comes and cut to shape. Place three front pieces on in position; mark and cut to shape. Glue, nail and sandpaper until smooth.

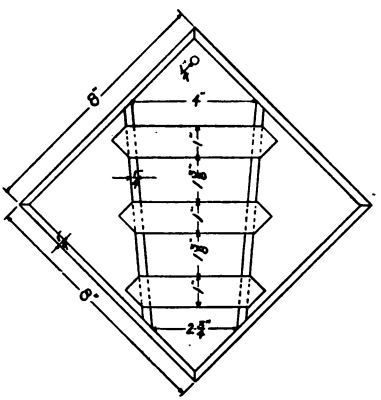

Figure 55. Whisk broom holder II.

14—Whisk Broom Holder III

Material: Basswood as follows: one piece ¼ inch by 5 inches by 9 inches; one piece ¼ inch by 5¼ inches by 5¼ inches; two pieces ¼ inch by 1⅜ inches by 5½ inches.

Tools Used: Saw, plane, marking gauge, chisel, dividers, hammer, scroll saw, brace, bit and square.

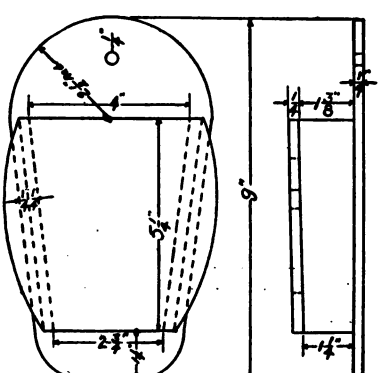

Figure 56. Whisk broom holder III.

Directions: Saw out stock. Lay out back, front and sidepieces to given dimensions; then work out to lines, using scroll saw and chisel.

15—Salt Box

Material: Basswood as follows: One piece 10 inches by 5 inches by ¼ inch; one piece 5 inches by 5 inches by ¼ inch; one piece 5 inches by 4⅞ inches by ¼ inch; two pieces 6 inches by 4 inches by ¼ inch; one piece 4 inches by 5 inches by ¼ inch.

Tools Used: Saw, plane, hammer, brace and bit.

Directions: Lay out the back, front, bottom and two sides. Plane these pieces to the proper size. Put the parts together, using hammer and small nails. Bore the hole. This is a very useful article for the kitchen. The salt will be handy and kept clean, if the cover of the box is closed.

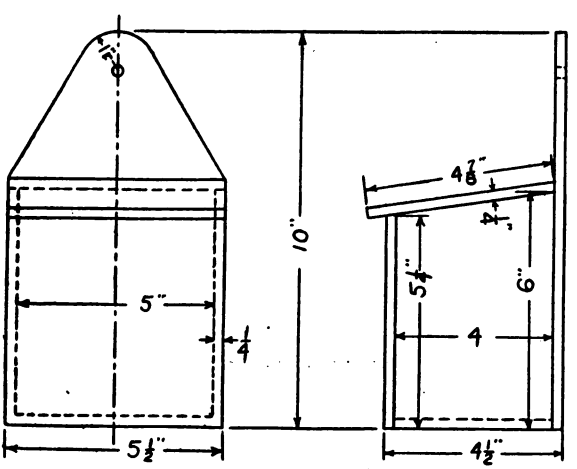

Figure 57. Salt box.

16—Match Box I

Material: Basswood as follows: one piece 3½ inches by 3½ inches by ¼ inch; one piece 3½ inches by 2 inches by ¼ inch; one piece 3 inches by 1¾ inches by ¼ inch; two pieces 8 inches by 3¾ inches by ¼ inch.

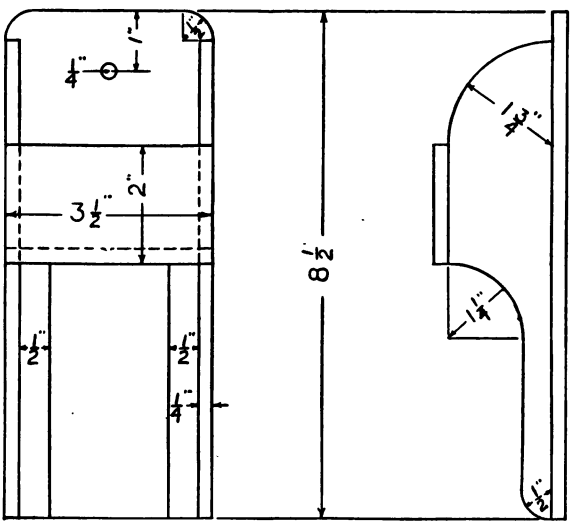

Figure 58. Match box I.

Tools Used: Plane, saw, hammer, knife, dividers, brace and bit.

Directions: Saw out the stock to the proper size, following the cut and directions given above. Lay out the parts, plane and whittle to the proper size and shape. Nail the pieces together and bore the hole.

17—Match Box II

Material: Basswood as follows: one piece ¼ inch by 3¼ inches by 7¼ inches; two pieces ¼ inch by 3½ inches

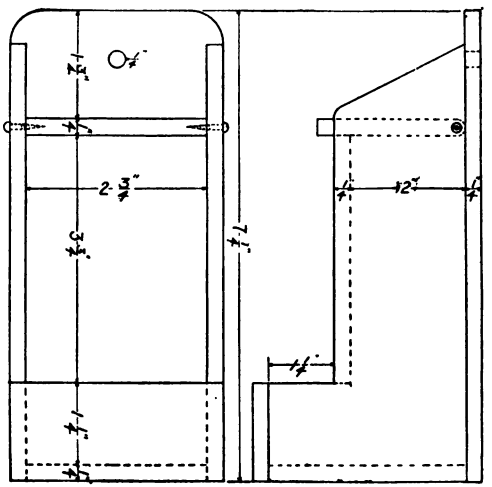

Figure 59. Match box II.

by 6¾ inches; one piece ¼ inch by 2¾ inches by 3¾ inches; one piece ¼ inch by 2¼ inches by 2¾ inches; one piece ¼ inch by 1½ inches by 3¼ inches; one piece ¼ inch by 2¾ inches by 3½ inches.

Tools Used: Plane, saw, dividers, screw driver, marking gauge, brace, bit and hammer.

Directions: Plane back to size. Round off two top corners; lay out the two sides and cut them to shape. Plane covers to proper size and round off back edge. Plane two front pieces to size; plane bottom to size. Glue and nail back, sides, bottom and front pieces. Put cover on with two screws, as shown.

18—Toothbrush Holder

Material: Basswood as follows: one piece 7½ inches by 2¾ inches by ¼ inch; one piece 2⅜ inches by 1½ inches by ⅜ inch.

Tools Used: Saw, hammer, plane, brace and bit.

Directions: Saw out the stock according to directions. Lay out the back and the holder. Plane the back and holder to the proper size. Lay out the chamfer, or bevel, on the back. Plane off the beveled edge to the line. Lay

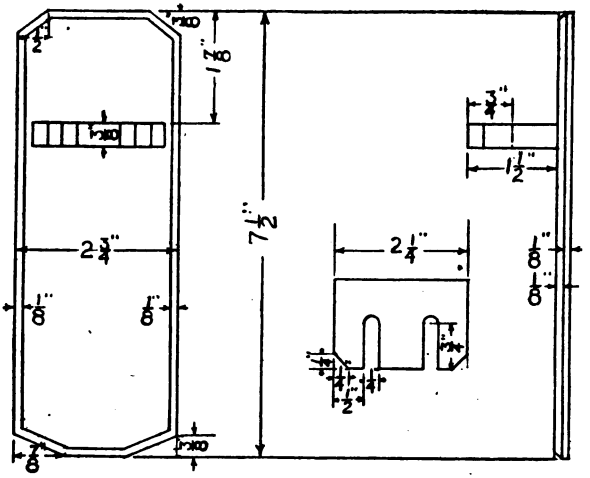

Figure 60. Toothbrush holder.

out the holes on the holder and bore them accurately with the brace and bit. Make the saw cuts. Study the drawing carefully. This is an article that should be in every home so that each member of the family can have a definite place for his toothbrush. Incidentally, it may be that more brushes will be used, if the racks are made and taken home.

19—House Nail Box

Material: Pine as follows: one piece ½ inch by 9 inches by 1 foot 2 inches; two pieces ½ inch by 2½ inches by 1 foot 2 inches; two pieces ½ inch by 2½ inches by 8 inches; one piece ¾ inch by 5 inches by 1 foot 1 inch; one piece ½ inch by 2½ inches by 1 foot 1⅞ inches.

Tools Used: Saw, plane, hammer, keyhole saw, dividers, brace and bit.

Directions: Saw out stock. Plane to dimensions. Lay out the handle as dimensions call for. Cut to line, using

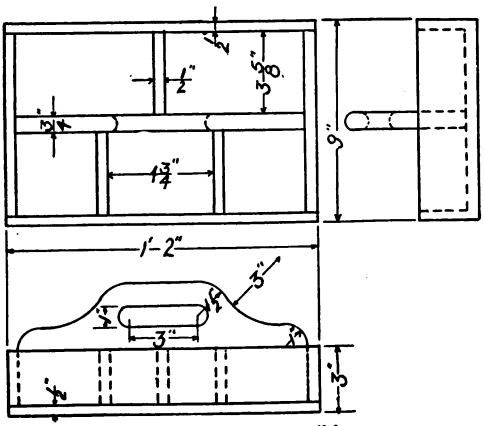

Figure 61. House nail box.

brace and bit and keyhole saw. Plane stock and cut for partitions. Nail on parts, as shown, and sandpaper until smooth.

20—Bird House

Material: Basswood as follows: two pieces 5¼ inches by 3½ inches by¼ inch; two pieces 4⅛ inches by 4 inches

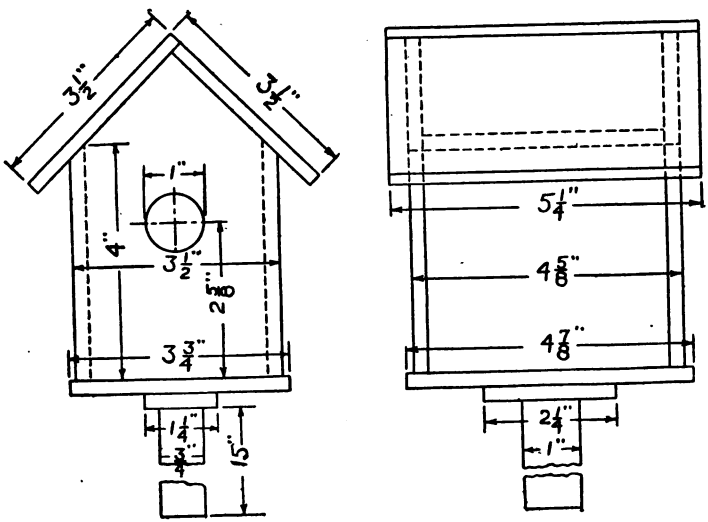

Figure 62. Bird house.

by ¼ inch; one piece 4⅞ inches by 3¾ inches by ¼ inch; two pieces 5½ inches by 3½ inches by ¼ inch.

Tools Used: Saw, plane, hammer, brace and bit.

Directions: Lay out end pieces and cut them to the proper size with the saw. Lay out roof boards and plane to size. Plane the post to size. Assemble the pieces and fasten together. Paint any color desired. Gray or green are probably best. Students should be encouraged to make bird houses and erect them in the home yards, as they will then become more interested in all common birds, seeing their beauty as well as usefulness.

21—Bread Board

Material: Basswood or oak 12 inches by 6 inches by ¾ inch.

Tools Used: Plane, saw, dividers, wood file and sandpaper.

Directions: Saw out the stock 12 inches by 6 inches by ¾ inch. Square one face. Square one edge with the squared face. Square one end with the squared face and edge. Cut to proper length and square the end. Cut to proper width and square the edge. Cut to proper thickness

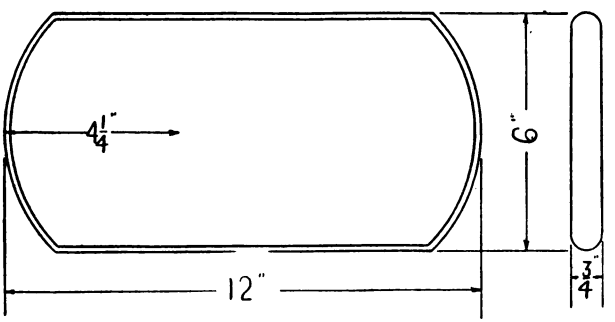

Figure 63. Bread board.

and square the face. Lay out curved ends with the dividers and cut with chisel. Lay out rounded bevel and work round with the plane. Smooth up the bevel with the wood file. Sandpaper the entire board until it is perfectly smooth.

22—Sleeve Board

Material: Pine or basswood as follows: two pieces 22 inches by 4¾ inches by ¾ inch; two pieces 8¼ inches by 4 inches by ¾ inch.

Tools Used: Saw, plane, chisel, wood file, sandpaper, brace and bit.

Directions: Saw out the stock according to directions. Plane the bottom to the proper size and round the four corners. Lay out the top board and plane to the proper size and shape. Make dowel holes and put in the dowels. Put in bolts. Use wood file and sandpaper on all rough edges. Sandpaper the top until perfectly smooth. This is a very useful article in the home and not difficult to make, if the drawing and the directions are followed carefully.

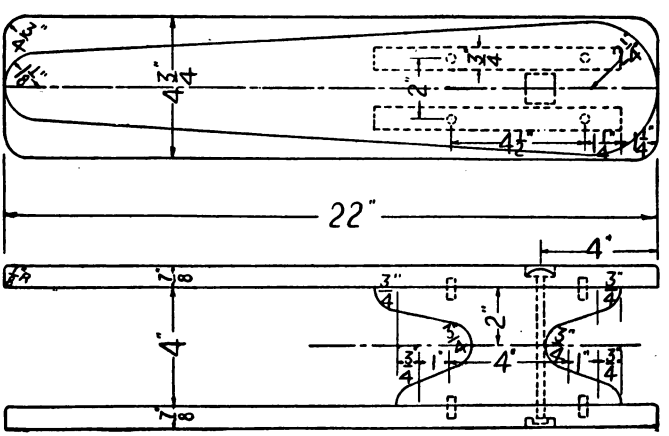

Figure 64. Sleeve board.

23—Knife Box

Material: Oak as follows: one piece 12¾ inches by 6½ inches by ¾ inch; two pieces 8 inches by 5 inches by ¾ inch; two pieces 12 inches by 3 inches by ¾ inch.

Tools Used: Plane, saw, hammer, dividers, brace, bit and sandpaper.

Directions: After studying the drawing, saw out the stock. Plane the bottom piece to the proper size. Lay

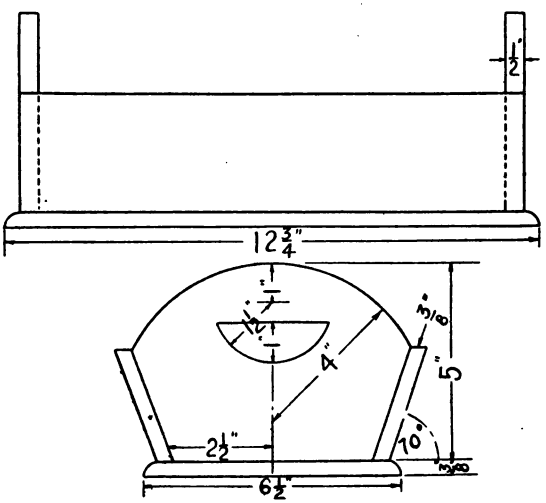

Figure 65. Knife box.

out the rounded bevel and plane. Lay out end pieces and cut them to shape. Cut the holes for handles in the end-pieces, using brace and bit. Cut sidepieces to proper size. Assemble and nail pieces together. Sandpaper the entire box until smooth. This is another very useful article. While it is called a knife box, knives, forks and spoons can be kept in it.

24—Floor Broom Holder

Material: Pine as follows: one piece 8 inches by 3 inches by ¾ inch; one piece 5½ inches by 2½ inches by ¾ inch.

Tools Used: Plane, saw, brace, bit, chisel, sandpaper and screw driver.

Directions: Square up the bottom piece and the holder to size, following the drawing and the directions. Lay out the bevel on the bottom piece and plane the bevel. Lay out the holder and cut to the proper shape. Bore the hole for the holder. Make saw cuts. Assemble and fasten the pieces together with screws, as shown in the drawing. Sandpaper carefully until smooth. This useful little article will be welcomed by any housekeeper. Unless there is a proper place for the broom, it is often short-lived and usually in the way.

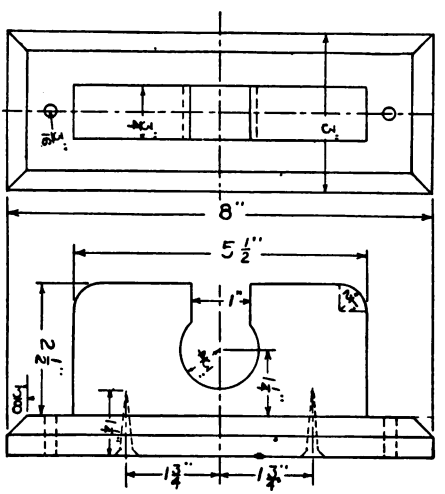

Figure 66. Floor broom holder.

25—Knife, Fork and Spoon Tray

Material: Oak as follows: two pieces 14⅜ inches by 2⅛ inches by ⅜ inch thick; three pieces 8¼ inches by 2⅛ inches by ⅜ inch; one piece 8¼ inches by 3⅛ inches by ⅜ inch thick.

Tools Used: Plane, saw, hammer, chisel, brace, bit and sandpaper.

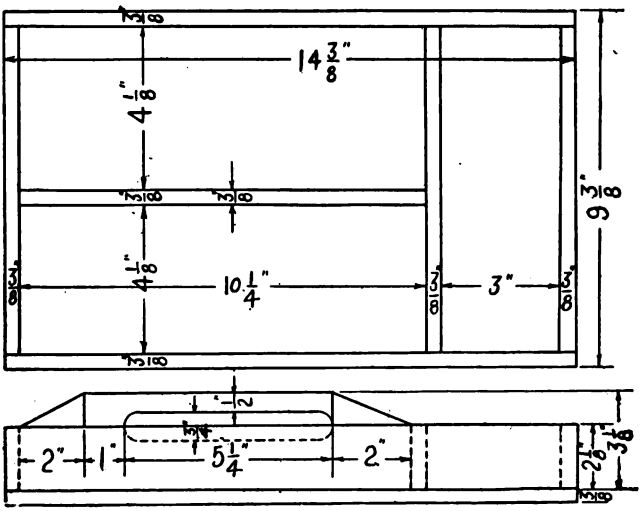

Figure 67. Knife, fork and spoon tray.

Directions: After studying the drawing, plane the sides and ends to the proper sizes. Plane the partitions to size. Cut out the handle and make it smooth. Assemble and nail pieces together. Sandpaper until smooth.

26—Bench Hook

Material: Oak as follows: one piece ¾ inch by 12 inches by 1 foot 4 inches; one piece ¾ inch by 2 inches by 12 inches; one piece ¾ inch by 2 inches by 10 inches.

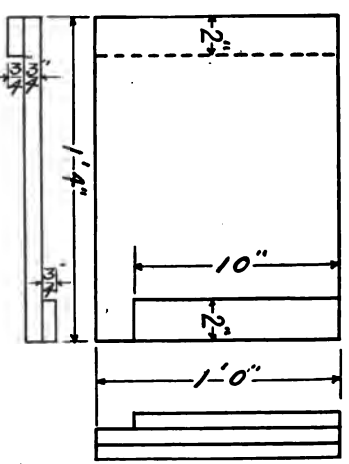

Figure 68. Bench hook.

Tools Used: Saw, plane, marking gauge, square, screw driver, brace and drill.

Directions: Saw out stock and plane to dimensions given. Screw the two end pieces on as drawing calls for, using drill slightly smaller than the shank of screw.

27—Necktie Rack

Material: Oak as follows: three pieces 16 inches by $\frac{7}{8}$ inches by $\frac{1}{4}$ inch; two pieces 5 inches by $1\frac{3}{4}$ inches by $\frac{1}{2}$ inch.

Tools Used: Plane, saw, chisel, sandpaper and hammer.

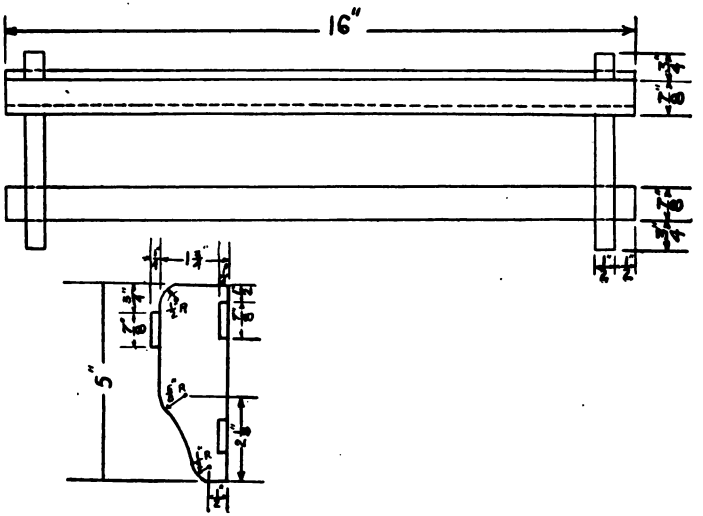

Figure 69. Necktie rack.

Directions: Plane the front and back pieces to the proper size, following the drawing. Lay out the ends and cut to proper shape. Nail the pieces together, and sandpaper carefully. Stain, using any desired color. The stain

may be put on by using a cloth and rubbing it into the wood. This handy article would make a useful Christmas present.

28—Towel Roller

Material: Pine as follows: one piece 21¾ inches by 4⅜ inches by ¾ inch; two pieces 3 inches by 2 inches by ¾ inch; one piece 20 inches by 1½ inches by 1½ inches.

Tools Used: Plane, saw, chisel, screw driver, wood file, brace and bit.

Directions: Saw out the stock. Plane and square up the back, the ends and the roller. Lay out the bevel on the back and plane it. Lay out the ends and cut to shape. Bore the holes in the ends for the roller. Plane the roller until it is round. Cut the tenons on the ends of the roller so they will fit the holes in the ends. Smooth the roller with the wood file. Fasten the end pieces to the back with screws, as shown in the drawing. Sandpaper all the pieces until they are smooth. Rub on the stain with a cloth. Put the roller in place. While the family towel is not sanitary, it is

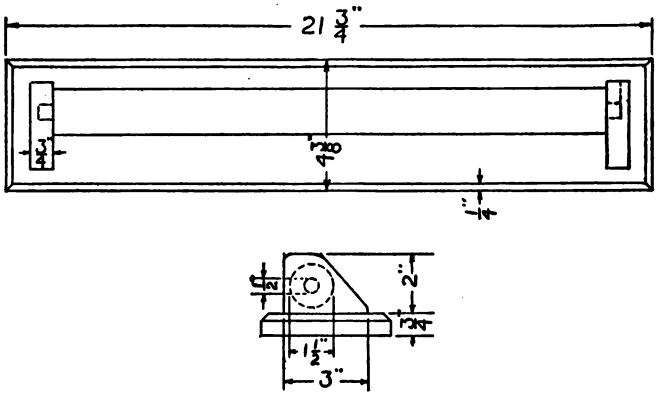

Figure 70. Towel roller.

better to have it on a roller than merely hung up on a nail. A roll of paper toweling could be fastened on the roller instead of the common towel.

29—Milk Stool

Material: Pine as follows: two pieces 10 inches by 9 inches by ¾ inch; one piece 16 inches by 5½ inches by ¾ inch; one piece 11 inches by 5½ inches by ¾ inch.

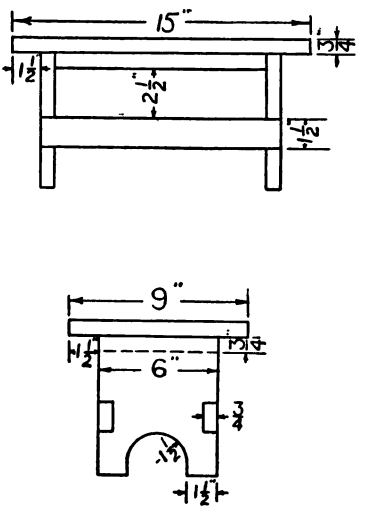

Figure 71. Milk stool.

Tools Used: Saw, plane and screw driver.

Directions: Saw out the stock. Square up the top, the sidepieces and the bottom. Lay out the bevel on the top and plane it to the line. Lay out the ends and cut to the proper shape. Bring pieces together and fasten with screws. Sandpaper until smooth. As many of these stools can be used in any dairy barn as there are persons milking. Boxes, up-turned pails, and other temporary things are unhandy, and a stool can be made with very little labor and expense.

30—Camp Stool

Material: Oak as follows: four pieces 21 inches by 1½ inches by ⅞ inch; four pieces 16½ inches by 1 inch by 1 inch.

Tools Used: Plane, saw, wood file, sandpaper, brace and bit.

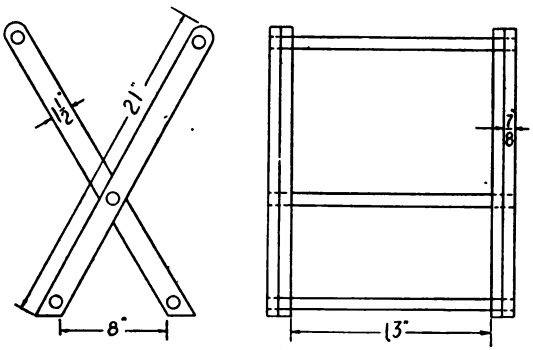

Figure 72. Camp stool.

Directions: Square up all pieces as given in the drawing. Bore holes in the sidepieces. Round up the crosspieces, using the plane. Bring the parts together and fasten them securely. After sandpapering the stool it should be shellacked, using a brush or a cloth. A piece of canvas or common grain sack may be cut to the desired size and sewed around the crosspieces. A few camp stools on the porch or on the lawn will give enough extra comfort to pay for the work of making them. Many boys plan an outing in the summer. These stools are collapsible and may be packed away with other camp utensils, or they may be made to come apart, the "take down" kind, and carried in the knapsack. Or carry the canvas and make the stool.

31—Another Toothbrush Holder

Material: Oak as follows: one piece 8 inches by 4⅓ inches by ½ inch; one piece 8 inches by 1½ inches by 1½ inches.

Tools Used: Saw, plane, dividers, bevel, sandpaper, brace and bit.

Directions: Lay out the back and cut to the proper shape. Cut the holder to shape, using the drawing as the guide. Fasten the pieces together securely. Sandpaper until smooth and rub on a stain. As will be noticed, this is a more difficult model than Number 18 and more durable.

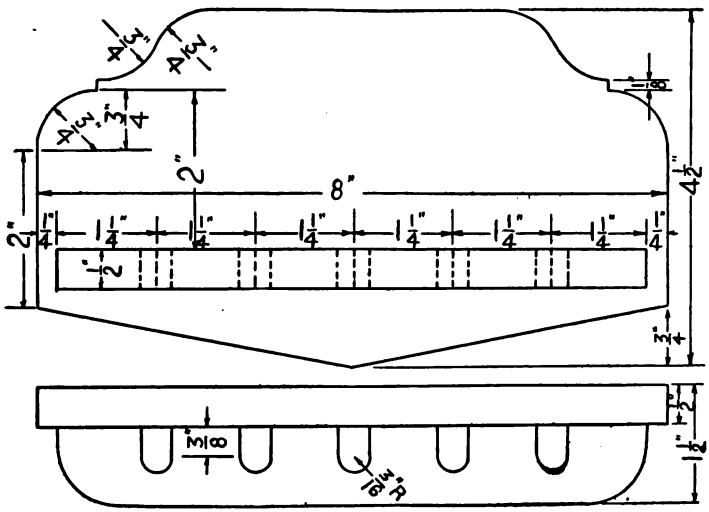

Figure 73. Another toothbrush holder.

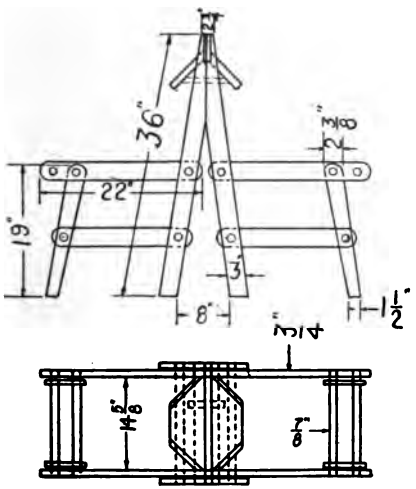

Figure 74. Tub stand.

32—Tub Stand

Material: Oak as follows: six pieces 22 inches by 2½ inches by ¾ inch; one piece 17½ inches by 4 inches by ¾ inch; ten pieces 16½ inches by 1 inch by 1 inch; one piece 16 inches by 5 inches by ¾ inch; two pieces 36 inches by 2½ inches by ¾ inch.

Tools Used: Saw, plane, brace and bit.

Directions: Study the drawing carefully. Square up all the pieces and cut them to the proper size. Work each piece to shape. Plane the crosspieces until they are round. Make them smooth with the wood file and sandpaper. Fasten the pieces together firmly. Finish with a coat or two of shellac. This is one of the most useful things that could be made for the kitchen. The rack can be folded up and put away when not in use. There is room for two tubs, and the wringer is fastened to the top of the stand. While it is more difficult to make than the other exercises given, it is not at all impossible for the average boy. It would also make a good home project.

CHAPTER V

HOME PROJECTS IN WOODWORK

The working drawings and directions for a few very useful home credit projects in woodwork are here given. They should suggest others. These projects have all been done by farm boys attending associated schools, and can be done by any bright, energetic young man.

If there is not already a workshop at home, one should be provided. It should contain a bench sufficiently large for a man's convenience. Boxes or drawers, shelves and racks should be provided and arranged conveniently for holding tools. The following list of tools and equipment will be needed:

Tools for Farm Shop

1 Bench
1 Vise
1 Jointer plane, 22-inch
1 Jack plane, 14-inch
1 Block plane, 6-inch
1 Ripsaw, 24-inch, 6 points
1 Crosscut saw, 22-inch, 8 points
1 Keyhole saw
1 Steel square, 2-foot
1 Try-square, 8-inch
1 Sliding bevel, 8-foot
1 Claw hammer
1 Pair dividers, 8-inch
1 Plumb and level
1 Hand axe
1 Set of chisels
6 Gouges, assorted sizes
1 Ratchet brace, 12-inch sweep
1 Set of general purpose wrenches
2 Monkey wrenches—1 large, 1 small
1 Glass cutter
1 Drawknife, 10-inch
1 Mallet
1 Spokeshave
1 Marking gauge
2 Hand screw drivers—one 5-inch,one 10-inch
1 Set of bits
2 Countersinks—1 for wood, 1 for iron
1 Breast drill
1 Set of drills

1—Workbench

Material: Fir or pine as follows: one piece 3 inches by 12 inches by 5 feet 8 inches; four pieces 4 inches by 4 inches by 2 feet 3 inches; three pieces 2 inches by 4 inches by 4 feet 2 inches; two pieces 2 inches by 4 inches by 1 foot 6 inches; three pieces 2 inches by 4 inches by 1 foot 4 inches; one piece ¾ inch by 12 inches by 4 feet 2 inches; one piece

¾ inch by 8 inches by 5 feet 8 inches; one piece ¾ inch by 3 inches by 6 feet; two pieces 2 inches by 3 inches by 1 foot 8 inches; two pieces ¾ inch by 3 inches by 8 inches.

Tools Used: Saw, plane, hammer, monkey wrench, screw driver, square, brace and bit.

Directions: Cut the legs to proper length and plane. Lay out housing for the 2 inches by 4 inches. Cut the side

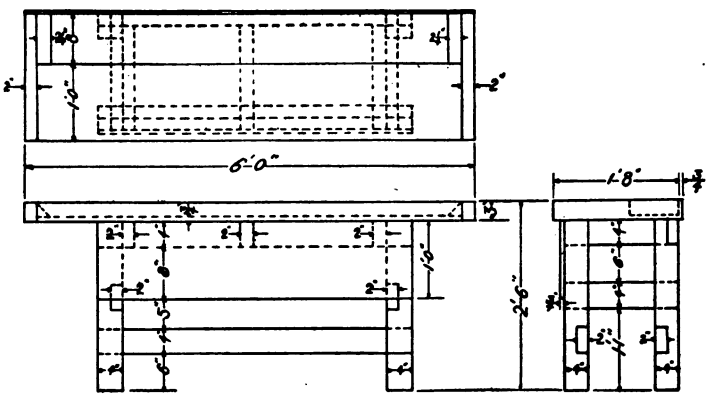

Figure 75. Workbench.

rails and end rails to length, fitting them into housing tightly. Bore holes through the center of each joint and bolt, using ⅜-inch bolts. Plane up the 2-inch by 4-inch by 1 foot 4-inch pieces, bolting them to the inside and top of legs. Plane front board to dimensions and screw to the legs. Nail the other 2-inch by 4-inch by 1 foot 4-inch pieces in place, as shown. Plane up the top to dimensions. Place the top in position, letting it extend out 1 inch over the front edge and 10 inches over the left end and fasten in place with screws. Plane up the ¾-inch by 8-inch by 5 feet 8-inch board to size and nail in place. Glue and screw

the two 2-inch endpieces in place. Glue and screw the ¾-inch by 3-inch by 6-foot piece to the back of the top. Sandpaper until smooth and shellac.

2—Shop Nail Box

Material: Pine as follows: one piece ¾ inch by 10 inches by 1 foot 2 inches; two pieces ¾ inch by 3¾ inches by 1 foot 3½ inches; two pieces ¾ inch by 3¾ inches by 10 inches; one piece ¾ inch by 6 inches by 1 foot 2 inches; one piece ¾ inch by 3 inches by 1 foot 1⅞ inches.

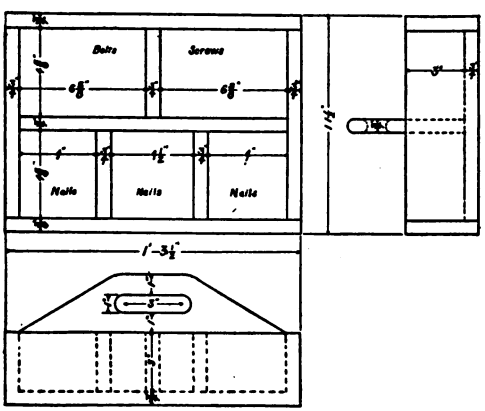

Figure 76. Shop nail box.

Tools Used: Saw, plane, hammer, keyhole saw, dividers, brace and bit.

Directions: Saw out stock. Plane to dimensions. Lay out the handle as dimensions call for. Cut to line, using brace and bit and keyhole saw. Plane stock and cut for partitions. Nail on parts as shown. Sandpaper until smooth.

3—Shop Horse

Material: Fir or pine as follows: one piece 2 inches by 4 inches by 3 feet; four pieces ⅞ inch by 4 inches by 2 feet; two pieces ⅞ inch by 5 inches by 7 inches.

Tools Used: Saw, plane, hammer, marking gauge, brace, drill and screw driver.

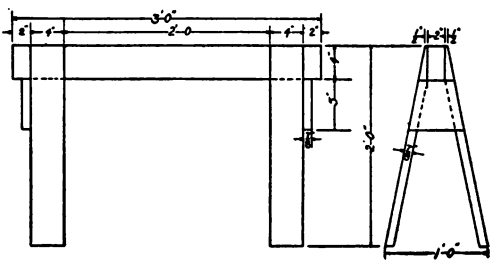

Figure 77. Shop horse.

Directions: Saw out the stock as dimensions call for. Bevel the four legs, as shown in the drawing. Plane the two endpieces to shape. Drill holes for screws and screw parts together, as drawing shows.

4—Fly Trap

Material: Pine as follows: Two pieces ¾ inch by 8 inches by 1 foot; three pieces ½ inch by 1 inch by 2 feet; two pieces ¾ inch by ¾ inch by 2 feet; three pieces ¾ inch by 6½ inches by 6 inches; two pieces ¾ inch by ¾ inch by 2 feet; three pieces ¾ inch by 1½ inches by 5 inches; two pieces ½ inch by 1 inch by 6½ inches; one piece ¾ inch by 10 inches by 2 feet; two pieces ¾ inch by 2 inches by 10 inches.

Tools Used: Plane, crosscut saw, ripsaw, keyhole saw, marking gauge, square, hammer and dividers.

Directions: Lay out two endpieces, as shown, and saw to lines. Get out two pieces ¾ inch by ¾ inch by 2 feet long, nailing to botton of the 2 ends, as shown in drawing. Cover this with fly screen leaving bottom open. Then nail in place the three brace pieces ½ inch by 1 inch by 2 feet. Lay out your three ¾-inch by 6½-inch by 6-inch pieces, as shown, and cut to shape. Make frame, using two ¾-inch by ¾-inch by 2-feet pieces and three ¾-inch by 1½-inch by 5-inch pieces. Nail together putting the ½-inch by 1-inch by 6½-inch cleat on each end. Then nail the triangular

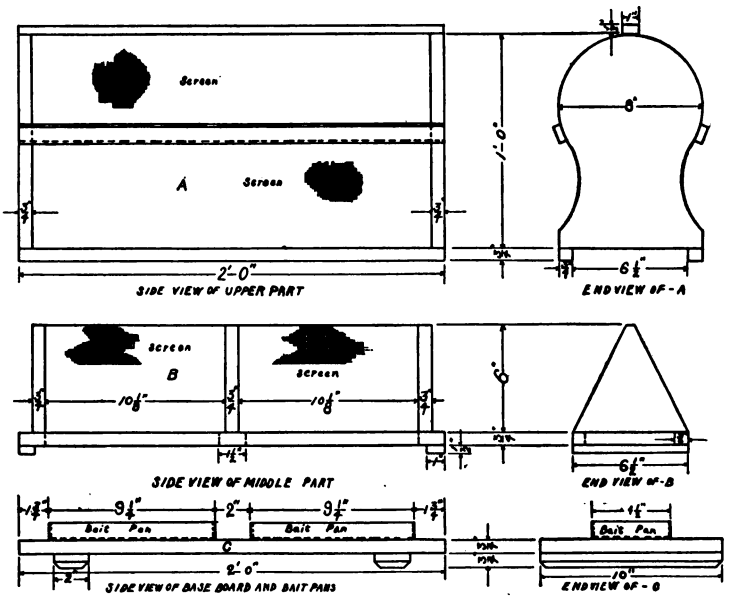

Figure 78. Fly trap, adapted from Minnesota Agricultural College bulletin.

shaped pieces in place, as shown in the drawing. Cover the two sides with screen, leaving bottom and top open. Get out the bottom piece. Screw two cleats on, as shown. Make two bait pans to dimensions and fasten them in place, as shown. Shellac or paint.

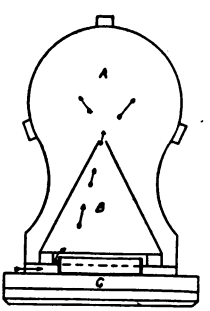

Figure 78a. Section view of fly trap.

5—Fireless Cooker

Material: Oak or pine as follows: Two pieces ¾ inch by 2 feet 11 inches by 1 foot 7 inches; two pieces ¾ inch by 1 foot 6 inches by 1 foot 7 inches; two pieces ¾ inch by 1 foot 6 inches by 2 feet 9½ inches; one piece ¾ inch by 2

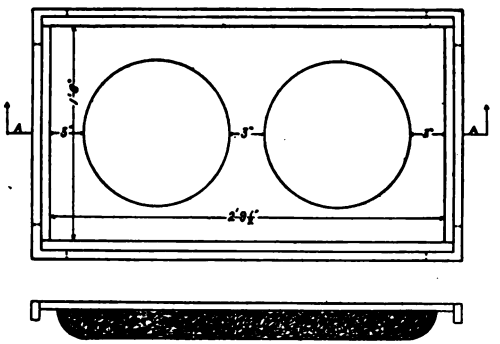

Figure 79. Fireless cooker. Above, top view with cover removed. Below, sectional view of cover.

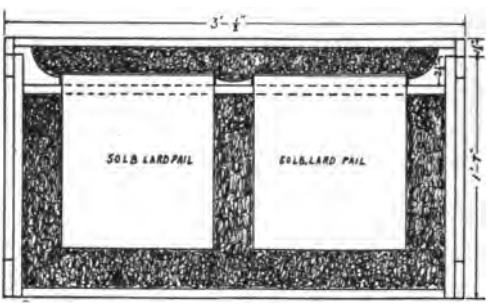

Figure 79a. Fireless cooker. Sectional view on A-A, showing cover and packing.

feet 11 inches by 1 foot 7½ inches; eight pieces ¾ inch by 4 inches by 1 foot 7 inches; two pieces ¾ inch by 4 inches by 1 foot 8 inches; two pieces ¾ inch by 2½ inches by 1 foot 8 inches; two pieces ¾ inch by 1½ inches by 4 feet; two pieces ¾ inch by 4 inches by 2 feet 1 inch; two pieces ¾ inch by 2½ inches by 3 feet 1 inch; two pieces ¾ inch by 1½ inches by 1 foot 9 inches; two 50-lb. lard pails or any other suitable can about the same size with a cover.

Tools Used: Plane, crosscut saw, ripsaw, keyhole saw, two-foot square, brace, quarter-inch bit, screw driver, hammer and marking gauge.

Directions: Glue up stock wide enough to make top, bottom, sidepieces, endpieces and the inside piece. Work out to given dimensions. Glue and nail sidepieces to ends. Fit in bottom. Glue and nail in place. Plane up the nar-

row strips to size for outside trimming. Glue and screw on from inside of box. Work out cover so it will fit flush with the outside edge of sidepieces and endpieces. Plane up 1½-inch strips to fit around cover, mitering the corners. Glue and screw on. Fill box about 3 inches from bottom with suitable packing, such as ground cork, hay, wadded paper or wadding. Place lard cans so there will be about 3 inches of space all around. Fill this space with packing to within 2 inches of top of can. Saw out inside piece to fit over the two cans, setting it down about 1 inch from top. Glue and nail in place. Make cushion for inside of cover, as shown, making it plenty large enough so that it will press down on cans tightly. Sandpaper all parts that show and stain and varnish.

6—Folding Ironing Table

Material: Pine as follows: one piece 1¼ inches by 1 foot 4 inches by 5 feet 6 inches. Oak as follows: two pieces ¾

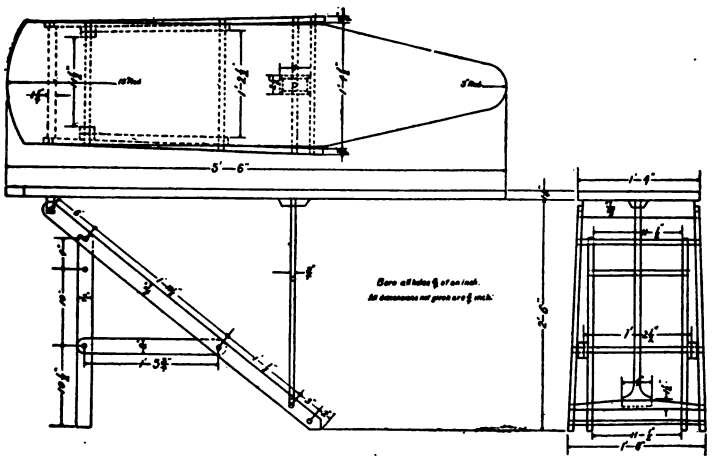

Figure 80. Folding ironing table.

inch by 2 inches by 4 feet; two pieces ¾ inch by 2 inches by 2 feet 1 inch; two pieces ¾ inch by 2 inches by 1 foot 8¾ inches; one piece ¾ inch by 4 inches by 2 feet 3 inches; one piece 1¼ inches by 2½ inches by 1 foot 4 inches; one piece ¾ inch by 1½ inches by 1 foot 6 inches; one piece 1 inch by ¾ inch by 1 foot 6 inches; one piece ¾ inch by ¾ inch by 1 foot 2½ inches; one piece ¾ inch by ¾ inch by 1 foot 5½ inches; one piece ¾ inch by ¾ inch by 1 foot 4½ inches; one piece ¾ inch by ¾ inch by 1 foot 1 inch.

Tools Used: Saw, plane, dividers, hammer, chisel, brace, bit and screw driver.

Directions: Saw out the stock for bottom pieces and plane to dimensions. Lay out holes, as shown, and bore, using ¾-inch bit. Round off ¾ inch at the edge of each end of the 1¼-inch by 2½-inch by 1 foot 4-inch piece. Plane the corners of ¾-inch by ¾-inch pieces, making them eight-sided. Round off ends to fit ¾-inch holes bored in the 2-inch strips. Lay out the ¾-inch by 4-inch by 2 feet 3-inch piece, as shown in the front support, cutting ¾-inch tenon on the 4-inch end and cutting a mortise in the ¾-inch by ½-inch by 1 foot 6-inch piece. Lay out the top, as shown, and saw and plane to lines. Fit all eight-sided pieces in, as shown, nailing through the outside 2-inch pieces. Fasten the top with screws.

7—Clothes Bar

Material: Oak as follows: sixteen pieces ¾ inch by 1¾ inches by 2 feet 1 inch; four pieces ¾ inch by 1¾ inches by foot 2 inches; two pieces ¾ inch by 1¾ inches by 2 feet; fifteen pieces ¾ inch by ¾ inch by 3 feet; one piece ¾ inch by ¾ inch by 2 feet 9 inches.

Tools Used: Saw, plane, chisel, dividers, hammer, brace and bit.

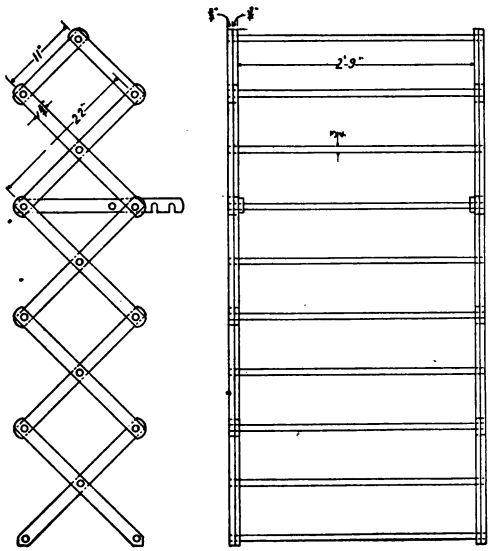

Figure 81. Clothes bar.

Directions: Saw out stock, plane the sidepieces to size and bore holes. Round off the rungs 1½ inches on each end. Plane corners, making them eight-sided. Put together, as shown, nailing through the outside pieces. Sandpaper.

8—Common Ladder

Material: Fir or pine as follows: two pieces 1¾ inches by 3½ inches by 14 feet; thirteen pieces 1½ inches by 1½ inches by 2 feet 3 inches.

Tools Used: Saw, plane, marking gauge, dividers, brace, bit and hammer.

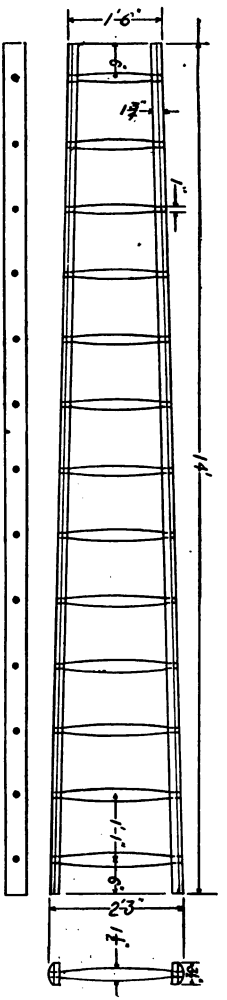

Figure 82. Common ladder.

Directions: Lay out sides to shape, as given, and bore holes. Work out rungs to shape and fit to sidepieces.

9—Outside Stepladder

Material: Oak as follows: two pieces ¾ inch by 3 inches by 6 feet 4 inches; two pieces ¾ inch by 1½ inches by 6 feet 3 inches; one piece 1 inch by 4 inches by 1 foot 7 inches; one piece 1 inch by 4 inches by 1 foot 3½ inches; one piece 1 inch

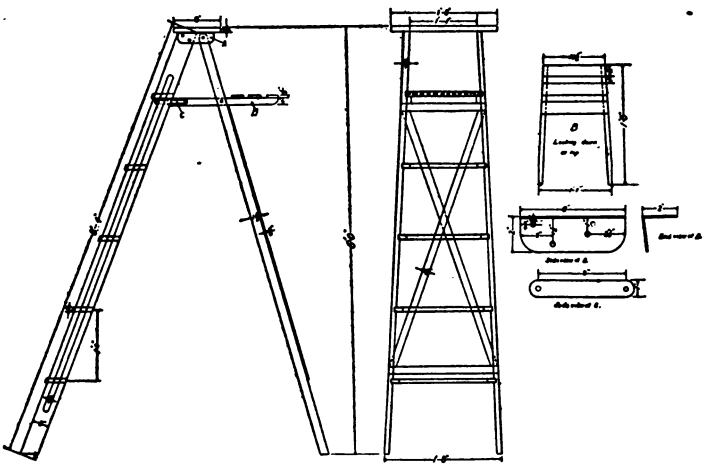

Figure 83. Outside stepladder.

by 4 inches by 1 foot 2½ inches; one piece 1 inch by 4 inches by 1 foot 1½ inches; one piece 1 inch by 4 inches by 1 foot 1 inch; one piece ¾ inch by 8 inches by 1 foot 8 inches; two pieces ¾ inch by 1 inch by 1 foot 8 inches; 3 pieces ½ inch by 2 inches by 11 inches; two pieces ¼ inch by 1½ inches by 3 feet 10 inches; one piece ¼ inch by 1½ inches by 1 foot 8 inches; one piece ¼ inch by 1½ inches by 1 foot 1 inch. Iron as follows: 2 pieces ⅛ inch by 4 inches by 6 inches; two pieces ⅛ inch by 1 inch by 6 inches.

Tools Used: Plane, saw, hammer, brace, bit, drill, marking gauge, keyhole saw and monkey wrench.

Directions: Saw out stock to dimensions and plane. Lay out two sidepieces for treads. House in ¼ inch. Plane treads to size, as given. Cut the ends of the 6 feet 4-inch pieces on a 20° angle. Fasten the treads in place with screws. Bend the two pieces of ⅛-inch by 4-inch by 6-inch iron to angle shown, drilling holes as shown. Bolt on to front stringers, using ¼-inch bolts. Plane the two back strips to dimensions. Round off one end, as shown, fastening to top with bolts. Let these pieces rest on back of stringers. Plane up the ⅜-inch strips, cut to dimensions and fasten on back. Get out stock for pail holder, as shown, fastening in place under the second tread, as shown, using bolts and ⅛-inch by 1-inch by 6-inch iron strips, as shown. Drill two holes through the top of the angle-iron on each side. Bolt the top tread to it. Sandpaper until smooth and shellac.

10—Shoe Blacking Stand

Material: Pine or oak as follows: four pieces 1½ inches by 1½ inches by 11¾ inches; two pieces ¾ inch by 5 inches by 1 foot ½ inch; two pieces ¾ inch by 5 inches by 8½ inches; one piece ¾ inch by 8 inches by 1 foot 1 inch; two pieces ¾ inch by 6 inches by 1 foot 4 inches; one piece ½ inch by 1⅝ inches by 10 inches; one piece ½ inch by 1 inch by 7½ inches; one piece ¾ inch by 2¼ inches by 8 inches.

Tools Used: Saw, plane, hammer, chisel, brace, bit, screw driver, marking gauge and dividers.

Directions: Plane legs to dimensions. Lay out the mortises, as shown, and cut out ¾ inch deep. Plane sides and ends to dimensions. Lay out and cut tenons. Plane bottom and fit in. Plane top. Fasten one half of the top to the sides and ends. Fasten other half with hinges.

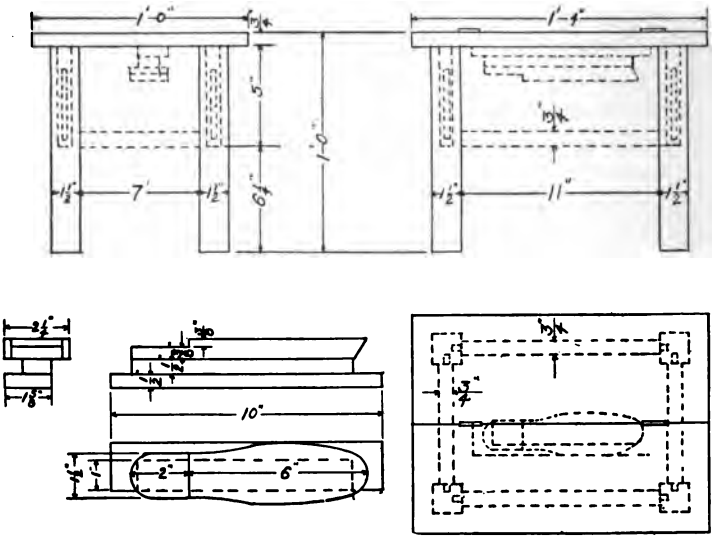

Figure 84. Shoe blacking stand.

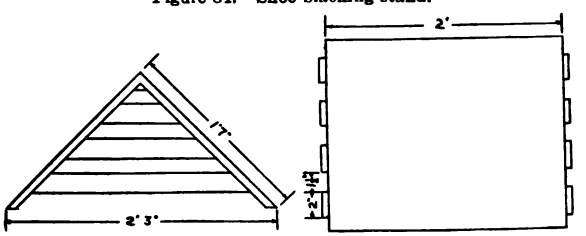

Figure 85. Chicken coop.

Lay out foot rest, as shown in drawing, and fasten to the under side of lower half of top. Glue mortise and tenon joints. Sandpaper until smooth.

11—Chicken Coop

Material: Pine as follows: four pieces ¾ inch by 12 inches by 24 feet; two pieces ½ inch by 1½ inches by 2 feet 10 inches; two pieces ½ inch by 1½ inches by 1 foot 9 inches;

two pieces ½ inch by 1½ inches by 1 foot 5 inches; two pieces ½ inch by 1½ inches by 10 inches.

Tools Used: Plane, saw, hammer, square, brace and bit.

Directions: See drawing. Join the two sides together. Nail sides in V shape. Put on slats, front and back. Paint.

12—Three-horse Evener

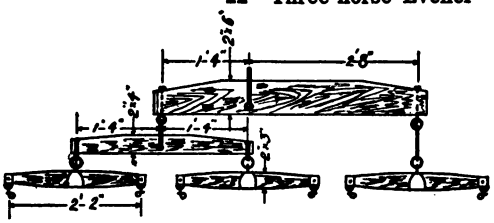

Figure 86. Three-horse evener.

Material: Oak as follows: one piece 2 inches by 6 inches by 4 feet 4 inches; one piece 2 inches by 4 inches by 3 feet; three pieces 2 inches by 3 inches by 2 feet 4 inches.

Tools Used: Saw, plane, hammer, wrench, draw knife, brace and bit.

Directions: Lay out the stock, as shown. Saw and plane to lines. Fit irons to whiffletrees. Bore holes for eye bolts and clevises, as shown. Sandpaper and paint.

13—Four-horse Evener

Material: Oak as follows: one piece 2 inches by 6 inches by 5 feet 4 inches; two pieces 2 inches by 4 inches by 3 feet; four pieces 2 inches by 3 inches by 2 feet 4 inches.

Tools Used: Saw, plane, hammer, wrench, draw knife, brace and bit.

Directions: Lay out the stock, as shown. Saw and plane to lines. Fit irons to whiffletrees. Bore holes for eye bolts and clevises, as

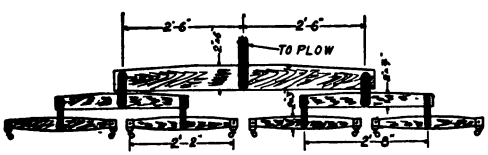

Figure 87. Four-horse evener.

shown. It is not necessary to use strap iron clevises. The same kind of irons as used on three-horse evener may be used. Sandpaper and paint.

14—Five-horse Evener

Material: Oak as follows: one piece 2 inches by 7 inches by 4 feet 4 inches; 2 pieces 2 inches by 4 inches by 3 feet; five pieces 2 inches by 3 inches by 2 feet 4 inches; one piece 2 inches by 6 inches by 1 foot 6 inches.

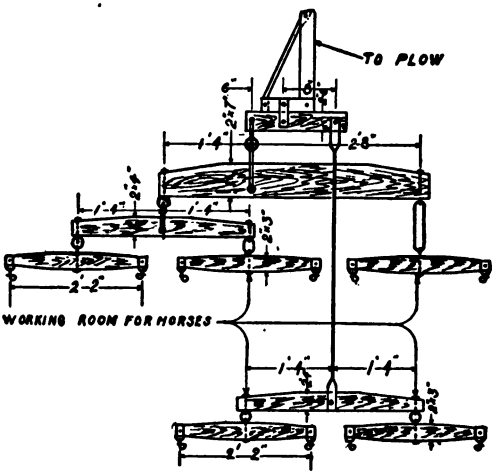

Figure 88. Five-horse evener.

Tools Used: Saw, plane, hammer, wrench, draw knife, brace and bit.

Directions: Lay out the stock, as shown. Saw and plane to lines. Fit irons to whiffletrees. Bore holes for eye bolts and clevises, as shown. It is not necessary to use eye bolts. Whiffletree irons and clevises may be used as on three-horse evener. Sandpaper and paint

15—Stock Rack

Material: Fir as follows: two pieces 3 inches by 6 inches by 14 feet. Pine as follows: eight pieces 1 inch by 6 inches by 14 feet; six pieces 1 inch by 4 inches by 14 feet; five pieces 1 inch by 8 inches by 14 feet ship-lap. Oak as follows: five

pieces 2 inches by 4 inches by 3 feet 2 inches; fourteen pieces 2 inches by 3 inches by 4 feet 9 inches.

Tools Used: Saw, hammer, square, wrench, brace and bit.

Directions: Cut the fir stock to dimensions given. Cut 2-inch by 4-inch oak to size. Bolt the same to stringers, using either an 8-inch common bolt or an 8-inch U bolt. Bolt on the stake irons, as shown, fitting stakes to same. Space off distances for sides, as shown in drawing, bolting the same to stakes. Space off distances on the end gate stakes and bolt in place. Screw a piece of 1 inch by 4 inches each side of end gate to hold the same in place using end gate rod at the top. Paint.

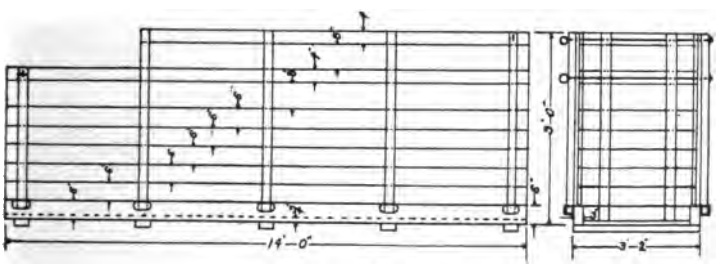

Figure 89. Stock rack.

16—Wagon Box

Material: Yellow poplar or spruce as follows: two pieces 1 inch by 14 inches by 10 feet 6½ inches; two pieces 1 inch by 14 inches by 3 feet; twelve pieces 1 inch by 2½ inches by 1 foot 2 inches; one piece ¾ inch by 7 inches by 2 feet 9½ inches; two pieces 1 inch by 3½ inches by 2 feet 8 inches. Oak as follows: two pieces 2 inches by 4 inches by 3 feet 2 inches; two pieces 2 inches by 4 inches by 4 feet. Twelve pieces 1 inch by 4 inches 12 foot fir flooring. One set of wagon box irons.

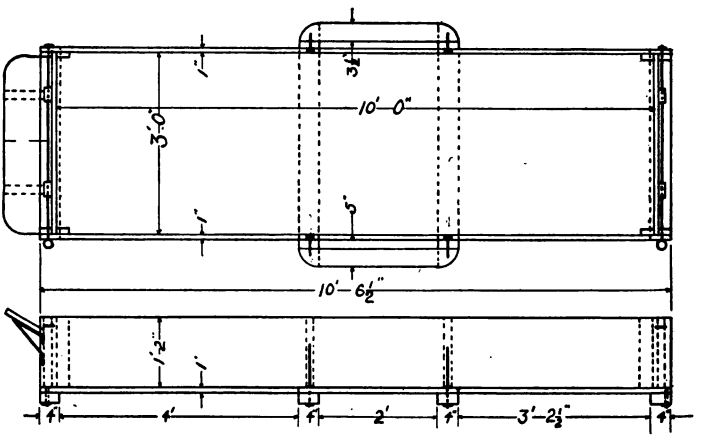

Figure 90. Wagon box.

Tools Used: Saw, hammer, square, dividers, keyhole saw, wrench, brace, bit and screw driver.

Directions: Cut the 2-inch by 4-inch oak to dimensions. Cut the flooring and nail to 2-inch by 4-inch oak. Rivet side irons to wagon box sides. Screw the cleats in place, as shown, then bolt them to the bottom. Cut end gates to dimensions. Screw cleats in place. Bolt the foot rest irons in place on the front of the end gate, bolting the foot rest to the same. Place the end gates in position, boring holes for end gate rods. Screw the 1-inch by 3½-inch by 2 feet 8-inch pieces in place and bolt the side brace irons on, as shown. Sandpaper and paint.

17—Farm Gate

Farm gates are too often allowed to sag and become a nuisance. A simple rigid gate may be made as follows: Saw six four-inch pine boards of ordinary thickness the length of the opening between the posts. If the posts are not set, place them twelve feet apart, as a gate that wide

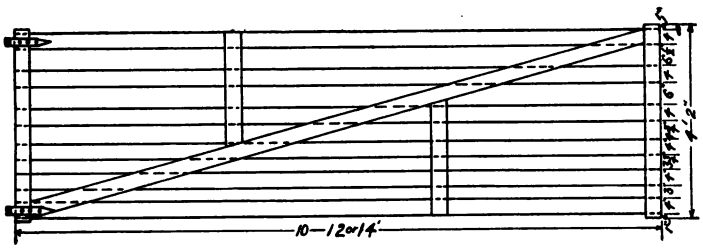

Figure 91. Farm gate.

is sometimes necessary. If the lumber is not already dressed, plane both surfaces and the edges. Using the same kind of lumber, saw two crosspieces for the ends, each four feet two inches long. Nail the six boards to these ends, keeping the top and bottom boards one inch from the ends of the crosspieces, as shown in the drawing. The spaces between the boards should be narrow at the bottom of the gate to prevent small animals from getting through. The drawing shows three inches for the first space, three and three fourths for the second, four and three fourths for the third, six for the fourth, and six and one half for the top space. These spaces should be accurately measured and marked before the boards are fastened. As soon as the boards are fastened lay a four-inch board diagonally across the gate from the lower hinge end to the upper other end. Mark and saw to fit. Nail to each board and clinch the nails. Using another four-inch piece of board, lay it so that one end is just even with the upper edge of the top board about three feet from the hinge end of the gate. Mark it to fit the diagonal brace. Saw and nail to the four boards and toenail to the diagonal. In a similar manner cut and fit a brace for the lower part of the gate at about seven and one half feet from the hinge end. Sometimes double bracing is desired and boards are fastened on each side of the gate. In this event it is best to use bolts

instead of nails, and a third hinge will be needed to support the extra weight. Use strong hinges. Give the gate two coats of good paint.

18—Bracing Corner Posts

It is sometimes said that the corner post is half the fence. Without a good corner post there can be no good fence. Notice any fence where the wire has sagged and you can usually trace the trouble to the corner. The strain has either pulled the post part way out or the post has not remained perpendicular. If barbed wire is allowed to sag in this manner, it becomes extremely dangerous to stock.

A corner post should be larger and one or two feet longer than the ordinary post. The hole should be dug correspondingly deeper and large enough to have plenty of room for setting. If a wooden post is used, short pieces of plank may be securely nailed at right angles to each other near the bottom of the post to prevent the wire from pulling the posts up. The hole may be partly filled with rock and the spaces filled with earth tamped in solidly or, better still, with cement. After almost filling the hole with earth, more rock should be placed at the surface. At the bottom of the post and at the surface of the earth are the places of greatest strain. See that the post is set so that it is perpendicular.

Bracing the post is the most important part of the process. Heavy poles may be used, or a four by four, if available. Saw a notch in the corner post about ten inches from the top and another in the brace post about the same distance from the bottom. Drive the brace firmly into these notches. In the same manner connect the corner post with the other post. The two fence posts nearest to the corner are used for brace posts. Using strong wire, brace the bottom of the corner post to the top of the two brace posts,

being careful to draw the wire tight and fasten it securely. Such a corner post will not give trouble. Setting a corner post and bracing it may be demonstrated on the school grounds very easily, if it seems desirable.

19—Road Drag

One of the most useful implements for road work is the King drag, or more commonly known as the "split-log" drag. It bears the name of the man who first made known its utility. It is made from a ten or twelve-inch log split in two. The halves are faced the same way and fastened about three feet apart with wooden bars. A chain is attached in the direction of the smooth faces and the drag drawn at an angle that will cause the earth to be pushed toward the center of the road. The drag may now be purchased in an improved form, but it is a good exercise for farm boys to make one, and for a rural school, where there are boys old enough, to do the work.

Suggest to the school board or to the officers of the farmers' club in the district that the school be allowed to keep the road in repair near the school for a distance of eighty rods or a half-mile, as seems best. Make a drag and "borrow" a team from home, the older boys taking turns. The road should be dragged very soon after each rain while the soil is still moist. A mistake is often made in allowing the road to get too dry before the drag is put on. Other students can assist in various ways in keeping the piece of road in repair. If neighboring schools enter into a con-

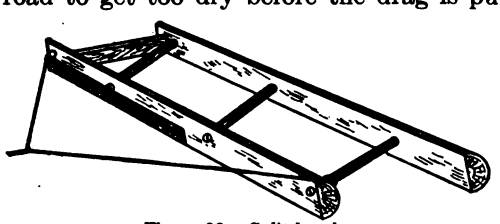

Figure 92. Split-log drag.

test for the best piece of road, and disinterested judges are appointed for the annual inspection, a great deal of interest can be maintained and much valuable knowledge learned about road work. If prizes are offered, still greater interest will prevail. Any group of "live boys" in a school district can get such a contest started.

To make the drag, get a log about ten inches in diameter and seven feet long. If there is a sawmill near, have the log sawed lengthwise. If not, split it carefully in two, and with a sharp ax or adz make the split surfaces smooth. From some hard and tough wood, such as maple or ironwood, make three crosspieces each three feet six inches long. With an ax or drawshave trim these down to two inches in diameter. With a two-inch auger bore a hole a few inches from one end of one piece of the log. Bore another hole two and a half feet from this one and another five feet from the first. These holes should be made at an angle of about thirty degrees. (See illustration.) In a similar manner bore holes in the other half of the log, keeping the angle in such a direction that the crosspieces will fit. Before fastening the pieces of the log together, arrange them so that the hole near the end of the front piece is at the left, and the one farthest from the end in the back piece at the left. Drive the pieces together and wedge the braces securely. Another brace, a two by four or something heavier, should be fastened near the end of the front piece to the end of the back piece near the other brace. This brace will strengthen the drag where the greatest strain occurs. If possible, get a piece of iron plate, and have four holes drilled in it at a blacksmith's. Place this plate on the bottom and cutting end of the front part of the drag. This plate will make the drag wear and cut better. It should be firmly fastened with countersink bolts. A chain about twelve feet long is fastened about

the middle of the log at the right end of the drag and extends over the top of the log at the left end and is fastened to the round brace. The team is hitched to the chain at about three feet from the end at the right. If desired, a bottom may be made of boards fastened to the braces.

If it seems impossible to construct a full sized drag and make use of it in road contests between schools as here suggested, much benefit can be derived from discussions and the making of miniature road drags, culverts and bridges as part of the knife work in manual training.

CHAPTER VI

HOME PROJECTS IN CEMENT AND IRON

As wood and lumber have become scarcer it has been more and more necessary to substitute other materials for them. Metals, especially iron and steel, have been in use for a long time, but recently a mixture known as concrete has come into general use on the farm as well as elsewhere. Less than fifty years ago the first cement mill in the United States was built in Pennsylvania. Now the annual output is approximately one hundred million barrels, and is increasing rapidly.

Cement is the basis of concrete. There are two kinds—the natural and the artificial. The former is found in the natural state, is burned, ground into a powder and put on the market. But little of this kind is now used. Portland cement, the best known artificial cement, has been so named, because it resembles a stone quarried near Portland, England. It is made by heating lime and clay in a special furnace. The principal ingredients of cement are silica, lime, iron oxide and alumina. It may be purchased in paper sacks, cloth sacks and in bulk, but the common form is the cloth sack which contains ninety-four pounds net. A sack of cement is approximately one cubic foot. Four sacks make a barrel. Sacks may always be returned to dealers and ten cents credit obtained for each. Cement must not be allowed to get wet, or even damp, as moisture hardens it and renders it unfit for use. It should be stored in a dry place, and never allowed to lie on the ground.

CONCRETE WORK

Concrete is made from a mixture of cement, sand, gravel and water. Great care must be taken in selecting and preparing this mixture. The sand must be sharp and free from all finer particles. If it contains clay, it should be washed and screened until only the coarse sand remains. Screening is very important, as the cement will then stick to the sand firmly and make a strong mixture. The gravel also should be coarse. A screen with a one fourth inch sieve is generally used for separating the sand from the gravel. That which passes through is sand and that which does not pass, is gravel. Gravel with a diameter of more than one and one half inches should not be used.

Mixing the materials is a very important part of the process. A common mixture is that known as the 1:2:4, meaning one part by volume of cement, two parts of sand and four parts of gravel. Each batch of concrete should be some multiple of this proportion. Sand and gravel must not be used indiscriminately as taken from the pit. Crushed rock is still better than screened gravel and should be used where it can be obtained. Care must be used, however, not to use soft rock or shale that will be affected by the weather, as concrete can be no stronger than its weakest ingredient.

The cement and sand should first be thoroughly mixed and then added to the coarse gravel or crushed rock. Mix all carefully before adding the water. Use only pure water and add to form a mortar just thin enough to run into molds.

Green concrete is easily cracked and must be protected while curing. The quality of the product will be largely determined by the way it is cured. During the first two or three days, concrete must be kept wet and covered with burlap or some other suitable material. It should be

sprinkled for several days and should not be used for a long time.

Uses of Concrete on the Farm

Walks. Every farm home should have some concrete walks, if not more than a few feet leading to the doors. Some farmsteads have concrete walks leading from the house to the barn and other outbuildings. Where the labor can be done at home and the materials, except the cement, obtained on the farm, the cost is very little.

The ground should be excavated to a depth of from eight to twelve inches, depending upon the climate, and a subfoundation of stone, gravel or cinders laid. The soil should be well packed before putting in the subfoundation. The latter is usually from four to six inches deep and should be drained, if necessary, to prevent water from standing in it, as water would freeze in cold weather and break the walk by upheaval. The subfoundation must be well tamped before laying the foundation.

The foundation is usually three or four inches deep and may be mixed in the proportion of 1:3:6, if coarse sand or crushed rock is used. The concrete should be laid rather soft so that when it is being packed down, moisture may be seen on the top.

A top-dressing, or wearing coat, of one half to one inch is made of cement mortar, one part of cement to two parts of sharp sand or fine screenings of crushed rock being used. This gives a smooth and hard wearing surface.

The walk must be divided into sections by cutting entirely through with a trowel or other sharp instrument. These sections should not be larger than eighteen inches or two feet square to prevent cracking. A list of tools needed and specific directions for constructing the walk may be obtained from any bulletin on concrete.

Basement Floors. A concrete basement or cellar floor has been found to be serviceable and economical. This kind of floor may be constructed in the same manner as the walks, excepting, perhaps, that greater care must be exerted to secure good drainage for the subfoundation. Division into small sections is not so necessary, four being sufficient for an average room. It is well to slope the floor slightly toward one corner and drain from that corner.

Stable Floors. If properly constructed, there is no good reason why horse stables, as well as cow barns, should not have concrete floors, which are economical and much more sanitary than wooden floors. Since a greater strength is required for this kind of floor, the foundation should be about six inches thick. A one-inch wearing surface will then be sufficient. Construct the same as for walks. A rough finish will prevent the animals from slipping.

Fence Posts. As fence posts become more and more expensive there is an increasing demand for a substitute for the wooden post. Concrete posts may be made for eighteen or twenty cents each, not counting the labor, and if properly constructed will last indefinitely. For reinforcement, wire or small steel rods may be used. Sometimes old fence wire may be utilized with little or no extra expense. One piece of steel or wire in each corner of the post about an inch from the surface is the common method of reinforcement.

Molds are made of wood in any desired size and shape. A tapering post is cheaper than a rectangular one, and just as useful in most cases. Posts are usually molded in a horizontal position, as that method is simpler than the vertical. The molds are made of dressed lumber, preferably one and one half inches thick. From one to a dozen molds may be used at the same time. They should be so constructed that the ends may be let down and the boards

between the posts released to take out the posts when dry enough. A bulletin on concrete from the state experiment station will give complete directions for making the molds, which lack of space prevents giving here.

The mixture is usually of a 1:2½:5 proportion, although 1:2:4 and 1:3:6 mixtures are sometimes used. The greatest possible care must be exerted to get the proper grades of sand and gravel, as a small amount of earth or clay in the sand will make the post worthless. The concrete is run into the molds and smoothed off with a trowel. The posts must be handled very carefully while "green" and should not be used for about three months after making.

Concrete Blocks. Concrete or "cement" building blocks are now quite common. Several different forms are made, but most of them are of hollow construction, not only to save material but also to provide a "dead air" space to make the temperature in the building more equable. These blocks are often made on the farm from homemade molds the desired shape and size for foundations and small buildings. If large quantities are desired, it would be more economical for several persons to co-operate and purchase a machine for making the blocks. See a bulletin for complete directions.

Other Uses. Concrete is also commonly used in the construction of hog troughs, drinking tanks, cesspools, culverts, etc. To construct some of these is beyond the ability of school boys. Hog troughs may easily be made of a 1:2:4 mixture poured into a homemade form the desired size and shape. The common V shape is easily made, but the bottom should be slightly rounded so that no food will remain and sour.

Boys who have selected some of the concrete work for "home credit" tasks have been delighted with what they

have learned about it. Some of the work suggested can be done at school.

WHITEWASHING

Every boy should know how to make and use whitewash. Outbuildings of all kinds can be kept sweet and clean by its use. Start with a small building, such as a chicken coop. Better results are obtained by using a brush than by a spray, although it requires more time. After the first application is thoroughly dry a second may be put on, if desired.

The Government whitewash discussed in some of the Farmers' Bulletins is the best. It may be made as follows: Put two pecks of quicklime in a boiler or washtub. Cover the lime with hot water and put a lid on the boiler. Let stand until all the lime is slaked, then strain it. Dissolve one peck of common salt in hot water and add to the lime. Boil about three pounds of rice to a thin paste and add this to the mixture. Dissolve one pound of glue in a gallon of warm water. Put about half a pound of powdered Spanish whiting into the glue, and mix all thoroughly with the lime. Let stand a few days. This mixture makes a much more durable, presentable and sanitary whitewash than the ordinary forms and it is inexpensive. Reheat before using, if possible. For use in damp, interior places, omit the glue. Cow barns and stables may be much improved by applying whitewash at least once a year.

IRON WORK

Care of Forge. To build a fire, clean out the little pocket in the forge, known as the tweir. Place clean shavings in the tweir, putting coke over the shavings, and light the fire, giving it a slow draft. After the coke is burning put

on coal until the fire is built up quite high. Bank around with wet coal. Use the best "smithy" coal obtainable. Keep the fire free from clinkers, shaking it down occasionally. Keep the clinker trap under the forge clean.

Methods of Heating. Iron can be heated to a much greater degree without burning than steel. Steel should never be heated beyond a cherry red for ordinary work, such as drawing out or punching. Blacksmiths speak of heating iron to a red heat, white heat and a welding heat. Beginners should use the red heat at first to avoid burning.

Tools for Blacksmith Shop

1 Anvil, 75 or 100 pounds
1 Blacksmith's leg vise
1 Forge, 18 or 20-inch hearth
1 Stock and set of dies
1 Cold chisel
1 Hardy
1 Soldering iron
1 Straight lip tongs
1 Bolt tongs
1 Tin snips
1 Ball-peen hammer, 1-pound
1 Cross-peen hammer, 2-pound
1 Blowtorch

FORGING

1—Figure 8

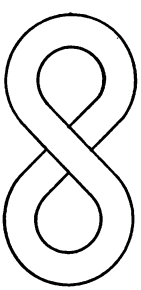

Figure 93. Figure 8 bending exercise as it appears when finished.

Material: Mild steel or wrought iron, ⅜ inch round by 8 inches long.

Tools Used: Hammer and tongs.

Directions: Heat the iron to required heat, bending it over horn of anvil. As this is a bending exercise, care should be taken to get the eyes as near alike as possible.

2—Gate Hook

Material: Mild steel or wrought iron, ⅜ inch round by 3½ inches long.

Tools Used: Hammer and tongs.

Directions: Heat iron to bright red. Draw out to ¼ inch square, as shown. Heat one end about 1 inch, placing edge on anvil and letting it extend from front edge of anvil

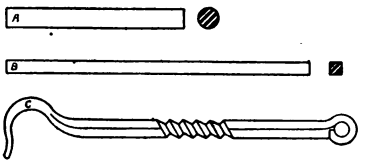

Figure 94. Gate hook. A-Round iron. B-A drawn out square. C-Finished hook.

on the face about ¾ inch. Then hammer down, making a shoulder. Round this end out to ⅛ inch. Bend to make eye, as shown, so that it fits into shoulder. Draw out other end round about 2 inches, making it slightly pointed. Bend to shape over horn of anvil. Heat center of hook. Hold with two pairs of tongs, one on each side and about 1 inch apart. Then twist, making one complete turn. Straighten hook, using mallet and block.

3—Making an Angle

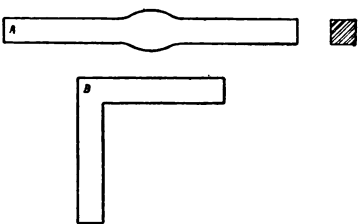

Figure 95. Making a right angle. A-Iron bar after heating and upsetting for bending. B-Finished angle.

Material: Mild steel or wrought iron, ½ inch by ½ inch by 7 inches.

Tools Used: Hammer and tongs.

Directions: Heat the piece in the center about 1 inch and upset, either by placing one end on anvil and hammering down on the other end or butting against anvil. Then reheat in center and bend either over edge of anvil or in vise. Then square up, keeping the stock to the same dimension.

4—Bent Hook

Material: Mild steel or wrought iron, ⅜ inch round and 7 inches long.

Tools Used: Hammer and tongs.

Directions: Draw out one end slightly pointed, as in A. Bend the eye over the horn of anvil, as shown in B. Bend

hook over the horn of the anvil, care being taken to have the eye come straight with the center of hook, as shown in C.

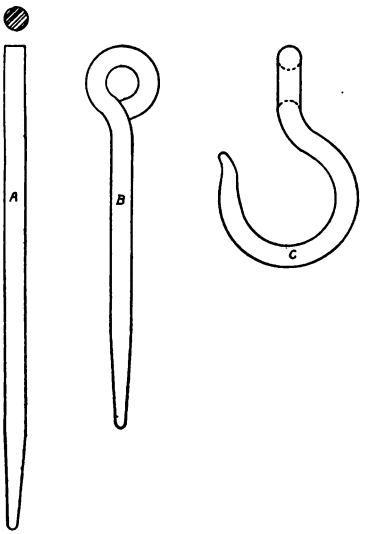

Figure 96. Bent hook. A-Iron drawn out and pointed. B-After completing the eye. C-Completed hook.

5—Lap Weld

This weld is the most used and it is also the easiest to make and the strongest, if properly done. The first thing to do in preparing this weld is to upset the end, which can be done by heating a short distance back from the end, then placing the hot end on the anvil while hammering on the other end. Then scarf off the ends, as shown in the drawings, having scarf side slightly convex. Scarf should never be concave, as it would form a pocket for scales, cinders and gas, making a poor weld. In welding, bring the iron to a welding or fusing heat, or, as some blacksmiths say, until it starts to flow. Always place the pieces to be welded so that they can be seen. One cannot weld with a dirty fire. Be sure that there are no clinkers or anything else to clog the fire. Do not get the iron too near the tweir or too close to the top, as the cold air will cause scales and you will be unable to make a good weld. Care should be taken that the iron is not burned, a good weld cannot be made with burned iron.

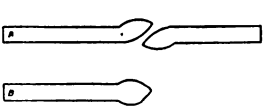

Figure 97. Lap, or scarf, weld. A-Stock upset and scarfed. B-Top view of A.

If, when you are heating for a weld, you see sparks, or, as some say, diamonds, going out of your fire, you will know that the iron is burning. The best thing to do is to take it out and cut off the burned part and scarf it over. Welding is one of the most difficult things to learn in forging and it takes a great deal of practice. It is a good plan for beginners to take short pieces, as shown in the drawing, and practice until they can make a good weld. If care is taken in upsetting and scarfing, the stock will be considerably larger at the weld. This extra thickness you can forge down with a hammer. If the work is well done, it will be impossible to see the weld.

6—Link, Ring and Washer

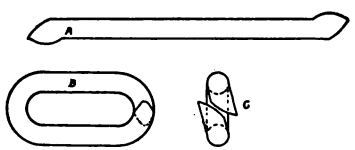

Figure 98. Link exercise. A-Stock showing method of scarfing. B-Stock bent into link ready to weld. C-End view showing scarfs in place.

Material: Mild steel or wrought iron, 3/8 inch round and 7 inches long.

Tools Used: Hammer and tongs.

Directions: Upset both ends and bend stock in the shape of a U, scarfing, as shown in the drawing; then bend the two ends so that the scarfs come together, as shown; heat to welding heat and weld on anvil. In making chains, two links are welded separately and linked to the third and the third then welded. In a similar manner make a ring and a washer.

7—Fagot Welded Hook

Material: Mild steel or wrought iron, 1/8 inch round by 8 inches long.

Tools Used: Hammer and tongs.

Directions: Bend the eye in the center of the stock, as shown, bringing the two sides together and keeping them at

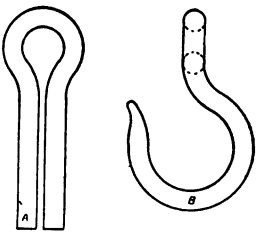

Figure 99. Fagot welded hook. A-Stock bent into shape for welding. B-Finished hook.

even lengths. Place in the fire and bring to welding heat, starting the weld at the eye and working to the end. Draw out the stock to a ⅜-inch diameter, point off end, as shown, and bend over the horn of anvil, keeping the eye and the center of the hook on a line. In this way a very strong hook is made which can be used in a great many places where the bent hook would not stand. This is known as the fagot method of welding.

8—Split Forging I

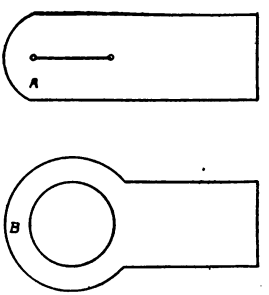

Figure 100. Split forging I. A-Stock split and end rounded. B-Completed product by this method.

To make a hole 1 inch round in a flat bar that is only 1 inch wide, split the bar, as shown in A of the drawing, and punch a little hole at each end of the split to prevent further splitting. Then drive a punch in the split and form the hole by swelling out the end of the bar. This is one form of split forging.

9—Split Forging II

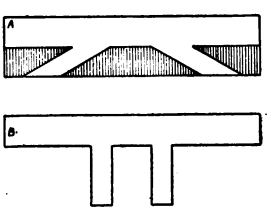

Figure 101. Split Forging II. A-Stock laid out. B-Stock cut out and worked to shape.

This is another kind of split forging that is very handy. Cut out shaded parts, as shown in A of the drawing, and work out to shape, as shown in B. A great variety of shapes can be made by using this method of work.

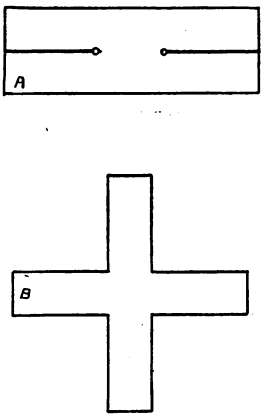

Figure 102. Split Forging III. A-Stock split as directed in Split Forging I. B-Stock worked to shape.

round the ends over the edge of anvil; punch a small hole in the bottom of the jaw and cut out, as indicated by the dotted lines in B; then finish as shown in C. Bend the other end in the opposite direction. The two jaws should be of different sizes. Do not harden.

10—Split Forging III

This is also a kind of split forging. If a +-shaped piece is wanted, split, as shown, and work out to required shape. The drawings show what is meant by this exercise.

11—S Wrench

The S wrench is a form of split forging. To make one, tool steel should be used and the stock must vary to comply with size of wrench wanted. Place the bar edgewise over the anvil and work out the shoulders; next draw out the stock towards the center as shown in A;

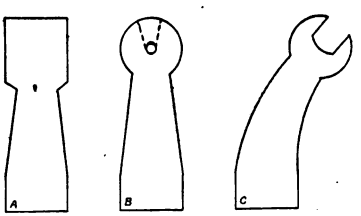

Figure 103. S Wrench. A-Stock with shoulders worked out. B-Rounded, holes punched, ready for splitting. C-Jaw worked out and shaped.

CHAPTER VII

HOME CREDIT WORK IN AGRICULTURE

There is no richer field for the application of scientific principles than that of the home project work in agriculture. It should not be the aim of any school, not even the agricultural college, to turn out scientists only. Such training is useful only to the extent that it can be made practical. While it is desirable to encourage home projects in general and to give suitable credit in school for such work, it is absolutely necessary to correlate it with the school work in agriculture, if definite results are to be obtained. It is not so much a matter of the leadership of the school as it is of intelligent co-operation on the part of the home and the farm.

If there is a farmers' club in the community, that is the proper organization to become affiliated with the school for the promotion of this kind of work. If not, the school must get the interest of the farmers of the district. The home exercises given in this chapter should be discussed in school, but carried out at home. These projects will suggest others.

SOIL STUDY

All soils have been formed from the rock of the earth's crust, by the action of wind, water, heat and other agencies. Gravel, sand, silt and clay are kinds of soil classified according to the size of the soil particles. Animal and vegetable decaying matter in the soil is called humus. Humus contains much plant food. Mineral plant food is "locked up" in the soil. Weathering and cultivation make this food available to the plant. A mixture of different kinds of soils

is called a loam. If a soil contains more sand than clay, it is a sandy loam. If more clay than sand is present, it is a clay loam. The fertile lands in the great corn belt are chiefly silt loams. Soil management, and consequently to a large degree farm management, must depend upon the character of the soil; hence, the value of an elementary study of soils.

For a soil tube, make a box two inches square at the ends, inside measurement, and four feet long. Get glass cut to fit one side so as to have a glass front. Fasten the soil tube in a vertical position and fill it with soil from an average farm just as it is found and arranged in the ground, the subsoil below and the surface soil on top. The tube can be filled best from an excavation for a cellar or well, as you can then see each layer of soil. More than one sample should be obtained, if the soils of the farms in the district are uneven. In case it is not possible to make or procure a soil tube for the school, bring from each farm represented samples of top soil, of soil six inches below the surface, and one, two, three and four feet below the surface, and study these in class. What plants send roots deeper than four feet? What has the subsoil to do with moisture? Why are sandy soils called light soils? Weigh equal volumes of sand, loam and clay. Which is the heaviest? Measure water and pour it into the different kinds of soils and determine which will hold the most water. What kind of soil makes the best subsoil? Why? Fill five lamp chimneys partly full of gravel, sand, loam, clay and leaf mold respectively, tying cloth over the bottom ends and submerging these ends about an inch. Water will rise by capillary action. In which does it rise most? Least? Put about an inch of dust on the top of the loam and note how high the moisture rises. How does the result show the value of a

dust mulch in cultivated crops? Your school can make a local soil survey that will be very valuable to the farmers of the community.

MINIATURE FARM

Many important problems in farm management may be shown in a miniature model farm. It is a general principle of rotation that grass should follow a grain crop, and a cultivated crop succeed a grass crop. In a simple three-year rotation these crops would follow in order every three years. In a four-year plan the hay land would be pastured the second year, before plowing up the sod for the cultivated crop. In a five-year rotation it is customary to have two grain crops in succession. An ideal arrangement is to divide the farm into as many equal fields as there are years in the system of rotation adopted. It can easily be shown that the shape of the field has a great deal to do with the number of rods of fence per acre required to enclose it. Although long fields require more fencing, they are more economical in plowing, seeding and harvesting than square fields. The location and size of the farmstead is an important item in farm management. The germination of seeds, differences in color and shape of the blades of different kinds of grain, rate of growth of each during twenty-four hours, the root systems, etc., are worth careful observation. All these and other important facts may be studied much better from the miniature farm than from books. A few weeks before school closes in the spring is the best time for this study. The facts can be observed also on farms in the vicinity at this time.

Make a box three feet square and about three inches deep. Fill it with pulverized soil or with sawdust. If the latter is used, soak it well before packing it firmly into the box. In some ways sawdust is the better, as it will not get

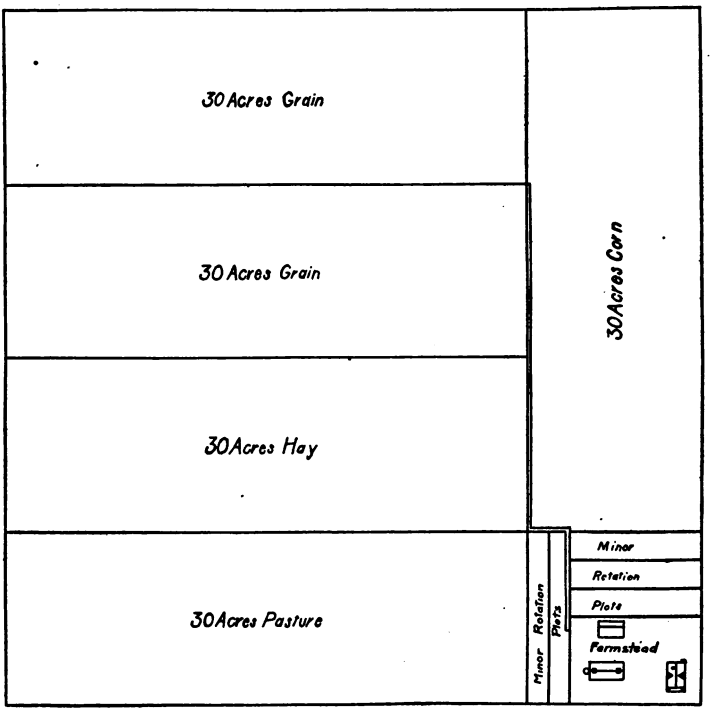

Figure 104. Diagram of a farm showing location of crops for one year in a five-year rotation. Farm buildings and calf and hog lots—the minor rotation plots—are located in farmstead of ten acres.

hard, and it retains moisture well. As the seed contains all the nourishment needed for two or three weeks' growth, it is unnecessary to use soil. For the fence, use toothpicks or splints and put one every inch around the outside of the "farm," allowing them to stick up about an inch above the surface of the sawdust. Supposing your "farm" represents 160 acres and you desire a five-year rotation, you can allow ten acres for the farmstead and thirty acres for each of the

Suggestive Rotations

Three-Year Plan

Year	Field A	Field B	Field C
1916	Grain	Clover	Corn
1917	Clover	Corn	Grain
1918	Corn	Grain	Clover

Four-Year Plan

Year	Field A	Field B	Field C	Field D
1916	Grain	Meadow	Pasture	Corn
1917	Meadow	Pasture	Corn	Grain
1918	Pasture	Corn	Grain	Meadow
1919	Corn	Grain	Meadow	Pasture

Five-Year Plan

Year	Field A	Field B	Field C	Field D	Field E
1916	Grain	Grain	Meadow	Pasture	Corn
1917	Grain	Meadow	Pasture	Corn	Grain
1918	Meadow	Pasture	Corn	Grain	Grain
1919	Pasture	Corn	Grain	Grain	Meadow
1920	Corn	Grain	Grain	Meadow	Pasture

five fields. To fence these, mark off nine inches (representing 40 rods) from the east line on the south side and place a dot on the edge of the box. Do the same on the north side, and run a toothpick fence between the dots parallel to the east line. Run a similar fence nine inches from and parallel to the south line. This plan will make a square ten-acre farmstead in the southeast corner and two thirty-acre fields, one on the east and on the south. Divide the remaining space into three equal fields, and you will have the ideal arrangement for a five-year rotation. Build a toothpick fence for a lane from the farmstead to the north field and your fencing will be complete. The accompanying diagram shows the plan. Sow grain in the two fields farthest north, timothy and clover in the two fields farthest south to repre-

sent hay in one and pasture in the other, and corn in the east field. This arrangement of the fields will represent the farm as it would appear one year in five after the rotation had become established. In actual field conditions, of course, the timothy and clover are seeded down with the preceding grain crop.

Small buildings may be made from colored paper and located on the farmstead. With toothpicks lay out fields for a five-year minor rotation plan within the farmstead for the hog and calf pastures.

Plan a three and a four-year rotation farm. Bring a plan of your home farm and see if you can improve it by re-planning and establishing a system of rotation, if one is not already used. Try a model farm on a large plot at home next spring.

GERMINATION TESTS

Students should become thoroughly familiar with the common methods of seed testing for grains and grasses. From your references, find out how to use the "rag doll" for corn testing, the "soup plate" and other methods of testing grass and small grain seed, and test some of the seed to be used on the farm. Seed testing is good agricultural work for February and March. Make a seed corn tester as follows:

Using box lumber or other available material, make a box twenty inches long, twenty inches wide and two inches deep, inside measurements. Mix sawdust with water until it is saturated and pack it firmly into the box. Cut a piece of cotton the size of the bottom of the box inside and mark it off into two-inch squares. This will make 100 squares, affording space to test 100 ears at once. Place the cotton cloth over the moist sawdust and take five kernels from the middle part of each ear and put them in the squares. Cover

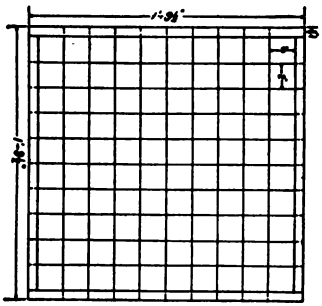

Figure 105. Seed corn tester, showing squares.

with another cloth or with a glass to hold the moisture. Keep the tester in a warm room of even temperature. Examine every twenty-four hours for five days and tabulate the results. When do the kernels begin to sprout? Does the root or top shoot start first? Are some sprouts more vigorous than others and what does this fact show? Discard all the ears that do not show 100% of strong germination, as only the latter kind of seed should be saved for planting.

GARDEN WORK

Select a rich piece of soil, well drained and free from weeds. The size will depend upon circumstances and may vary from a few square feet for the youngest boys and girls to a large tract for a commercial garden for the older ones. About thirty feet is a good length for a row but the garden may be as long or as wide as desired. The garden should be plowed early enough in the fall to check the growth of weeds and to bring buried weed seeds to the surface where they will germinate and be killed by frost. Fall plowing also disturbs the eggs or pupae of various kinds of insects and many of them are destroyed. A heavy coat of well rotted barnyard manure should be plowed under, and the soil harrowed a few times to conserve the moisture. As soon as it is dry in the spring, the soil should be thoroughly pulverized with a disk and harrowed until fine. Do as much of the labor with horses as possible.

The garden should be planned during the winter and the seeds purchased in time to test them. Better still, save

some of your own seed. The students of a school might well plan their gardens together as part of their agricultural work, exchanging varieties of home grown seed and thus saving the expense of purchasing. The testing should be done at school a few weeks before the seed is needed. Plats of each garden may be planned and drawn, and approved by parents and teacher. The plat should be drawn to scale and show what the garden is to contain and where each kind of seed is to be planted. Then follow the working drawing when the garden is being planted. Copies of the plat should be preserved at school and at home for reference.

A few principles of gardening should be kept in mind. Plant the smallest vegetables, such as onions, carrots, beets, etc., in a part of the garden by themselves in rows about sixteen inches apart. The larger things, as corn and potatoes, should be far enough apart to use a horse cultivator, unless the garden is very small. Space should be left and kept cultivated for plants that are to be transplanted, such as cabbage, tomatoes, cauliflower, celery, etc. These should be started early in window boxes. If done at school, one box of each variety will be sufficient for the entire school. The school should have a hotbed made and cared for by the students. Borrow the storm sashes from the home, if necessary. In case the garden soil is dry when the seed is planted, it should be packed and made firm over the row. This packing will enable capillary action to bring the soil water to the surface. A dust mulch between the rows while the plants are growing will conserve the moisture. Do not allow weeds in your garden. A weed is "any plant out of place." Get some bulletins on gardening, keep records of your receipts and expenditures and exhibit your products at the school in the fall.

WEED COLLECTION

Weeds do millions of dollars' worth of damage annually, a large part of which could be saved, if the boys and girls learned to identify them in school and later practiced the proper methods of eradication on the farm. All weeds come under three general classes—annual, those that produce seed and die during one season; biennial, those that grow to maturity, produce seed and die the second season; and perennial, those that live on year after year and produce seed annually. Examples of annual weeds are pigeon grass, mustard, wild oat and Russian thistle; biennials are represented by burdock and bull thistle; and some of the worst perennials are Canada thistle, quack grass, dandelion and yellow dock. Perennial weeds are particularly obnoxious, because many of them produce new plants from the roots as well as from the seed. Methods of eradication, or ways of getting rid of weeds, depend upon the class to which they belong. Annuals and biennials must be prevented from seeding, but prevention of seeding is not sufficient for the perennials, and some way of pulling or killing the roots must be devised. Rotation of crops is the best general method of destroying and preventing weeds, but spraying, smothering, pulling by hand and other methods are employed. Study bulletins and other references on weeds for further information.

Make a herbarium. Use oak tag or other stiff paper and allow a page each, of about ten by fifteen inches, for about twenty-five weeds. With the aid of the references, the teacher and the farmers in the community, collect twenty-five of the worst weeds in your school district. Press them and mount in your herbarium. If possible, get leaves, flower or seed and a thin section of the root. Write a description of the weed, give the class to which it belongs and state how

best to get rid of it. Make a case for a permanent exhibit for the schoolhouse as class work. Get twenty-five small "pill" bottles about two inches long at the drug store and after thoroughly drying the seed, fill each bottle with one kind of weed seed. Label each bottle and make a thin wooden case to hold the collection. Collecting weeds may be made an individual exercise as well as the basis for a general school collection. It is interesting to note the different kinds of seed dispersal, such as wind, water, animals, etc., and to classify a collection on this basis. After becoming familiar with the weed seeds, test samples of grains and grass seed for purity as part of your agricultural work. Use Farmers' Bulletin No. 428 and others from your own state for this work.

INSECT COLLECTION

Insects probably do more damage to the crops of the United States than weeds. Not all, however, are injurious. Some are very beneficial in destroying injurious insects.

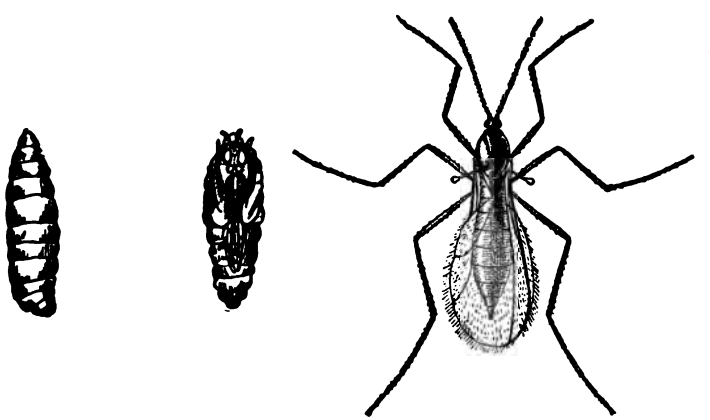

Figure 106. Hessian fly, showing larva, pupa and adult, or fly; greatly enlarged.

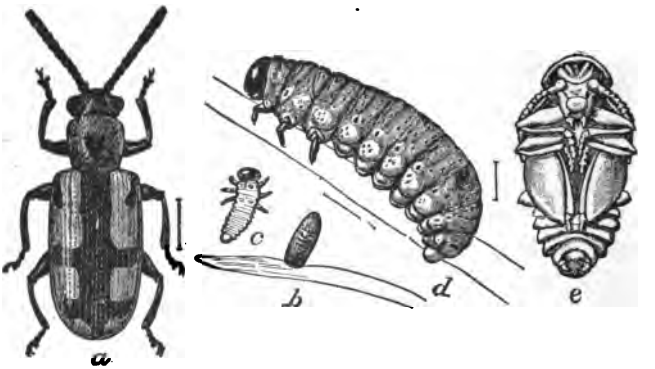

Figure 107. Typical beetle, the asparagus beetle, showing (a) adult, (b) egg, (c) young larva, (d) full grown larva, (e) pupa; enlarged. (Chittenden.)

Students should study each class of insects and learn how to exterminate the injurious kinds. These may be divided into biting insects and sucking insects. Biting insects can be poisoned. Sucking insects get their food from the juices of the plants and can be killed by stopping up their pores, or breathing spaces. An insect breathes through openings in the sides of the abdomen, and hence cannot be drowned by putting its head under water. A soap or kerosene emulsion is used as a spray to close the breathing pores. In general, the half-winged bugs are the sucking insects and the sheath-winged beetles are biting insects. The larvae, or "worms," of other insects, such as butterflies and moths, are often very

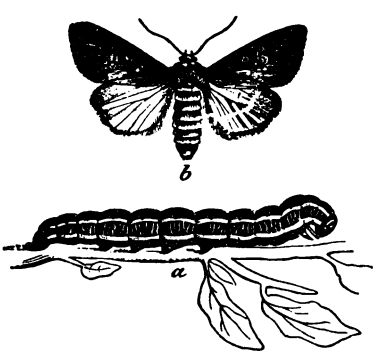

Figure 108. Typical moth, the zebra caterpillar and moth. (Riley.)

injurious. Some of these "baby" insects should be collected and a breeding cage made from a small wooden box with wire sides. Place soil in the bottom and keep it moist. Cocoons should be gathered in the fall and kept in a warm place. In this way the life history of insects may be studied at first hand. The information gained should be of great value later.

A collection of adult insects should be made for the school by the students, and home credit given for individual collections. Make a box the desired size, for example, sixteen by twenty-four inches, and have a glass cover to prevent moths from destroying the mounted specimens.

COLLECTION OF WOODS

Make a panel of thin wood and mount on it the different kinds of wood found in the district. There should be cross and longitudinal sections of each kind. The cross-section is made by sawing off a block from a small tree or bush, making it one half inch thick. It should show the bark and rings of growth. The longitudinal section is made by splitting a block about four inches long and planing one surface smooth to show the grain of the wood. The sections should be made as nearly uniform in size as possible. This exercise is a valuable one, as the average person is unfamiliar with many of the common kinds of woods.

STUDY OF BIRDS AND RODENTS

One of the most interesting projects for which home credit should be given is a study of the common birds. This, being outdoor work, affords abundance of healthful exercise. A notebook should be a constant companion and, with a kodak, the field work is still more interesting. Notes should be written in permanent form into a "Birds That I Know" booklet.

Birds are classified as land, water, game and birds of prey. Some go south for the winter; others do not. Make a table of these migrations with dates in the spring and fall. Some birds are injurious, destroying grains, fruits, beneficial animals and other birds. Common ones are the English sparrow, the kingfisher and the crow. These should be destroyed. Other birds are highly beneficial and should be protected. Still others are prized for their songs and plumage. Some of the beneficial birds are as follows: Robin, house wren, song sparrow, orchard oriole, bank swallow, barn swallow, blue jay, cardinal, red-winged blackbird, red-headed woodpecker, killdeer, quail, dove, screech owl, barn owl, buzzard, humming bird, cowbird and meadow lark. Nearly all these, as well as many others, can be observed and studied in your community. Birds feed chiefly upon insects and other injurious pests and hence should be protected. State and national laws protect most of these birds, but you can help also. Bird houses to protect from cold and wet, crumbs thrown out when snow is on the ground and watching that cats and other animals do not molest the young birds just from the nest are some of the ways.

Figure 109. Baltimore oriole.

While most birds are friends and should be protected, the rodents, or gnawing animals, are serious pests and should be exterminated. Their sharp, chisel-like teeth enable them to do much damage in orchard, garden and field.

The common gray rabbit, or cotton-tail, by gnawing the bark and biting the shoots of fruit trees and shrubbery, probably does more damage in the winter than in summer.

As their natural enemies hawks, owls, foxes, wolves, etc., become fewer, the rabbits must be more carefully guarded against. Trees and shrubs should be protected by guards of burlap, heavy paper, etc., or by repellent washes, such as lime-sulphur solution. Rabbits may be poisoned by soaking the buds of young shoots in strychnine. Poisoned fruits and vegetables may also be used. Traps will help.

Gophers do much damage in gardens and grain fields. The mounds show the presence of pocket gophers. The striped gopher eats insects as well as vegetable food and is, to that extent, beneficial. Gophers may be trapped or poisoned.

Field mice do great damage to grain and other crops. Much of the injuries to orchard trees in winter can be traced to those animals. Since several litters are produced during the season, they soon become very numerous, unless war is declared. Mice, as well as rats, may be poisoned or trapped.

Moles feed largely on insects, but frequently become a garden pest on account of the burrows and mounds. They may be trapped or poisoned.

Woodchucks, or ground hogs, should be trapped or poisoned where they become pests. Most boys know how to use the trap effectively.

STUDY OF MACHINERY

The parts of some of the common kinds of farm machinery can be obtained for class work, and probably some worn-out machines can be secured for permanent use. What cannot be studied in school can be done on a nearby farm by the class or as individual work at home. Among the implements that should be studied, and all the important parts named, are the following: Wagon, buggy, manure spreader, harrow, disk, cultivator, plow, drill, mower, rake and grain harvester. From implement dealers secure catalogs and

repair lists for the machinery that is to be studied. Name all the important parts. After becoming familiar with the parts, take some machine apart, as a mower or a binder, and reassemble it. Some old machines should be kept in a shed at the school for this work. The tools needed are a few wrenches, a hammer, cold chisel, punch, screw driver and pliers.

The parts for two common implements are here named. The common walking plow: Handles, beam, clevis, frog, heel, landside, wing, point, share, shin and moldboard. The grain binder: Bull wheel, grain wheel, axle, drive chain, crank shaft, countershaft, pitman, cutter bar, sickle, section, clips, dividers, platform canvas, elevator, reel, binder attachment, needle, packers, knotter, butter, twine box, tension, bundle carrier, levers, tongue and neck yoke. The parts for other machines may be learned from the lists of extras already suggested.

STOCK AND GRAIN JUDGING

Secure score cards free of charge from your experiment station and follow the directions there given for judging live stock. It is usually possible to get some stockman in the district to bring animals to the school for demonstration lessons in judging. This work should be supplemented by excursions to farms where well bred stock may be studied. Each student should fill out a score card for the most common breeds of cattle, horses, hogs, sheep and poultry found in the district. If judging is not done at school, home credit should be given to students who do the work elsewhere. Score cards for grains may be obtained and judging done in a similar manner.

APPLE TREE GRAFTING

Save some apple seeds at home and in the fall plant them a few inches apart and about two inches deep in rows. The

seedlings from these will grow during the next season and be ready to graft the following winter. Get scions from the last season's growth of the variety you desire to have the tree. Cut off the top of the seedlings near the ground and graft the scions into them. In larger nurseries, the seedlings are dug in fall, stored and grafted indoors in winter, only pieces of roots being used. Get a bulletin on grafting and learn how to make grafting wax and how to cut and place the scion and the stock so that the growing layer of the one will come in contact with the growing layer of the other —the most important factor in grafting. The wax is to bind the wound made in the operation of grafting and protect it from disease. Apple seeds do not reproduce the same variety of apple tree as that on which they were grown, but any kind of apple seed may be used for growing the stock. Sometimes wild seedlings are used for the stock, as the tree will then be hardy and any variety can be grafted on it. Old trees are often "top-worked"; that is, limbs are cut off and other varieties are grafted on. In this way, several varieties may be grown on one tree. Grafting is an interesting and useful art and one easily acquired by practice.

STRAWBERRY RAISING

This is one of the most profitable of the fruit projects. The strawberry is a universal favorite and can be grown in every country. Most varieties originated from a South American species, and a few from the wild strawberry of the United States. The plant thrives best in a rich, warm, sandy loam. A northern slope is best, as it retards the bloom in spring where there is danger of frost. The plot of ground should be heavily fertilized and plowed in the fall. It should be disked and thoroughly worked in the spring, making the soil loose on top and compact below. For northern climates

spring planting is best, cultivating during the summer and allowing the runners to set during the fall before the cold weather. Fall planting is the usual method in the South where a crop is picked the next winter. One-year-old plants with white, fibrous roots are used for spring planting, and spring plants are used when they are planted in the fall. Old plants have dark roots and must be avoided for new beds. The plants should be set as soon as possible after they are taken from the ground. To prevent the roots from drying out they are often packed in a furrow. This operation is called "heeling-in." If but a small bed is set out, the plants are best in hills where they can be hoed on all sides, but the matted rows should be used for larger patches so that they can be kept clean with horse cultivators. The runners should be trained with the rows so that dust and straw mulches may be kept between the rows. The latter is applied first as a winter protection for the plants and is removed in spring after all danger of frost is past.

Diseases and insects that attack the plants and berries should be carefully studied and remedied. Rust on the leaves should be treated with Bordeaux mixture. On large fields, the leaves often are mowed and burned. Leaf roller may be destroyed by spraying with arsenate of lead. The best preventive of cutworms and white grubs is not to plant on sod. Cutworms may be killed by "planting" poisoned bait, but great care must be exerted to prevent chickens or animals from getting it. White grubs cannot be reached by poisoning. When lack of vigor in plants indicates their presence, dig out and kill.

The berries may be marketed fresh or canned, as may be more profitable in your community. Pint and quart boxes as well as the crates, for the fresh fruit, may be obtained in the "knock-down" and considerable saved, if

you put them together yourself. Berries to be shipped should be picked slightly greener than those for canning. They should be sorted before boxing and only sound plump berries put into the crates. For information on canning strawberries, see description of outfit and method given in "Canning as Club Work," Chapter VIII.

CHAPTER VIII

CONTESTS AND CLUB WORK

Garden and canning clubs have been organized in nearly every state in the Union. The Federal Government has assisted the movement by sending experts to various parts of the country, and state departments of agriculture have cooperated through their extension work. Mr. T. A. Erickson, state leader of boys' and girls' club work for Minnesota, gives five reasons why every school district should have one or more of these clubs. They are well worth considering.

1. To bring the school, home and farm into closer cooperation.

2. To encourage boys and girls to assist their mothers in having a good supply of vegetables and fruit for the table, thus helping to reduce the cost of living, and to teach boys and girls how to save what is often otherwise wasted.

3. To interest the boys and girls in gardening and in the best methods of growing the tomato and other standard vegetables.

4. To teach the best methods of canning what is not used fresh.

5. To provide a means by which boys and girls may earn some money and at the same time learn many valuable lessons.

There are many fruits and vegetables that may be grown profitably by school boys in their home gardens. Tomatoes and strawberries are probably the most profitable, as there is always a ready market for these, and the surplus is easily canned. In fact, the tomato is popular on account of the canning that goes with that club work, as most of the prod-

uct is sold as canned goods. Many boys have entered the acre corn contests, and for that reason directions are given for doing that kind of club work. Sweet corn may be substituted for the field corn, if preferred and part of the crop canned in the same manner as the tomatoes. In that case a full acre would not be required unless three or four boys formed a partnership and purchased a home canning outfit together. Garden peas have been grown and canned successfully by some of the clubs.

Insects and weeds are deadly enemies of garden, field and orchard, and must be constantly guarded against. Poor seed is also often responsible for small yields. It is necessary, therefore, that boys make a careful study of these pests and also learn how to test seeds for purity and germination, if they are to get the best results. Hence, these subjects are given as much consideration as space will permit. Consult bulletins and reference books for further information.

ACRE-YIELD CORN PLOT

If there is no acre-yield corn contest in your district, start one by growing an acre of corn yourself and getting as many of the other boys and girls of your school to enter as you can. Then affiliate with the extension division of your state experiment station.

Select an acre from rich clover sod, if available, and, after applying a heavy coat of well rotted manure, plow it about six inches deep as early in the fall as possible. Disk and harrow often enough to kill the weeds during the fall and to conserve the moisture. Continue this harrowing in the spring several times before planting. As soon as danger of frost is past, plant only pure, ear-tested corn of the variety desired. Plant thick enough so that the plants can be thinned to four healthy stalks in a hill. Cultivate as often

as possible during the growing season, especially after each rain. Be careful to do shallow cultivation after the first few times, or the roots will be cut and the plants injured. Check-row the corn land three feet six inches each way. Get directions from your state experiment station or county agent for husking and weighing the yield, and enter the state contest, if there is one. It is always advisable to compete whether you secure any prizes or not, as you will learn the best methods of corn culture for your locality. There are almost unlimited possibilities in corn growing. You will not find it difficult to grow more to the acre than is grown by most of the farmers in your community. Try it, as hundreds of other boys have done. Keep careful records and find the profit as well as the cost of production.

POTATO YIELD CONTEST

If an acre is too much for a potato yield contest, try a half or a fourth of an acre. Prepare the ground in the same manner as suggested for the corn. Select large, pure seed of the desired variety, and if a planter is not available use great care in planting by hand. Study bulletins for information on potato culture. Keep records of the receipts and expenditures and ascertain the cost of production. Show a sample at the school exhibition in the fall. The following score card is adapted from one issued by the extension division of the Minnesota College of Agriculture:

Score Card for Potatoes.

I. YIELD—25 POINTS.

No. of Points	Things to Consider	Value of Points	1	2	3	4	5
1	Size of tubers	10					
2	Number in a hill	10					
3	Compactness in the hill	5					
	Total score	25					

EXPLANATION OF POINTS.

I. Yield: Can the sample be relied upon to produce a large yield even in spite of unfavorable conditions?

1. Size of Tubers.—Individual potatoes should be fairly large, indicating strength and constitution.

2. Number in a Hill.—Hills with only a few good-sized potatoes are undesirable, also hills with a large number of under-sized potatoes.

3. Compactness in the Hill.—Potatoes should be compact enough to gather easily and spread enough not to push out of the ground.

II. SALABILITY—25 POINTS.

No. of Points	Things to Consider	Value of Points	1	2	3	4	5
1	Soundness	10					
2	Size	5					
3	Shape	5					
4	Skin	5					
	Total score	25					

EXPLANATION OF POINTS.

II. Salability: Are they what the market demands? Are they attractive in appearance? Will they bring a good price?

1. Soundness.—Potatoes should be free from scab, rot, sunburn and bruises: also from damage due to bad handling. They should not be hollow.

2. Size.—Potatoes should be large and of uniform size.

3. Shape.—Tubers should be similar in shape and free from deformities and irregularities.

4. Skin.—Skin should be firm, clean, bright and clear; uniform in color; a white skin, other things being equal, is preferable.

III. CULINARY VALUE—25 POINTS.

No. of Points	Things to Consider	Value of Points	1	2	3	4	5
1	Mealiness when boiled and baked	5					
2	Color when cooked	5					
3	Evenness in cooking	5					
4	Flavor	5					
5	Eyes	5					
	Total score	25					

EXPLANATION OF POINTS.

III. Culinary Value:

1. Mealiness, when Boiled and Baked.—Potatoes that are immature, large and coarse, or with a thin, papery skin, and also those grown in heavy, wet clay soils, are liable to be soggy.

2. Color when Cooked.—Potatoes should have uniform, white color throughout and should not turn yellow or dark upon standing. They should be free from brown or blackish spots, and from dark or reddish streaks, especially near the stem and under the eyes.

3. Evenness in Cooking.—The different potatoes and parts of each potato should cook quickly and uniformly. Potatoes which are hard and watery when cooked, or those having hard, watery spots or with a tendency to be yellow, will cook unevenly.
4. Flavor.—Potatoes should have a sweet, pleasing taste. Sunburned, sprouted immature potatoes, or those which have been exposed to light, will have a bad flavor.
5. Eyes.—Deep or sunken eyes, and those protruding in clusters, are objectionable and cause a large loss in preparation for cooking.

IV. TYPE AND PURITY—25 POINTS.

No. of Points	Things to Consider	Value of Points	1	2	3	4	5
1	Trueness to type	15					
2	Freedom from mixture	10					
	Total score	25					

EXPLANATION OF POINTS.

IV. Type and Purity:
1. Trueness to Type.—Indicated by the uniformity in size, shape, color and characteristics of the tubers.
2. Freedom from Mixture.—A mixture of varieties is objectionable because of difference in manner of growth, time of ripening and in keeping and storing qualities.

SUMMARY OF POTATO SCORE.

	Points Considered	Value of Points	1	2	3	4	5
I.	Yield	25					
II.	Salability	25					
III.	Culinary value	25					
IV.	Type and purity	25					
	Final score	100					

TOMATO CONTEST

This has been one of the most popular and successful projects in club work and, where conditions are favorable for tomato raising, it is strongly recommended. A century ago the tomato was rarely grown and then only as an ornamental plant. It was thought to be poisonous until its food value was discovered accidentally. The tomato is now one of the most valuable vegetable crops in the United States, and is extensively grown in almost every other country. No other fruit or vegetable is so much used for canning purposes.

The young tomato plant is very tender and must not be transplanted until all danger of frost is past. In the northern states this time will be about the middle of May. The plants must, therefore, be started in window boxes or hotbeds, and transplanted to the garden. Start them about six weeks before they are to be set out in the open. There are a great many varieties of tomatoes, but the large, late kinds are best for canning. The plants should be set in rows at least four feet apart to allow plenty of room for horse cultivation and for the development of the plant. The distance apart in the row will depend upon the variety, as space enough for growth is necessary. Tomatoes thrive best in a rich, sandy soil and require plenty of warm weather during a long growing season. They must be kept free from weeds and insects and should not only be cultivated often, but kept hoed close to the plant. As soon as the young fruit is formed, the plant should be well supported by staking and tying or part of the crop will be spoiled on the damp ground. When time to ripen, cut away the surplus branches to let the sun in and allow the nourishment that would feed the branches to go to the green tomatoes. Early varieties may often be marketed fresh in small baskets at handsome profits, but the individual or the club should own a home canning outfit and can the main crop. Write to the national and state departments of agriculture for bulletins and information pertaining to the culture and canning of the tomato. Farmer's Bulletin No. 521 is good for the latter.

CANNING AS CLUB WORK

Canning has become very popular among both boys and girls during the last few years, both as home projects and as club work. As home work, it is usually done by the girls, but as club work, it is important for both girls and boys. Fruits,

vegetables and soups are canned and glass sealers and tin cans are used for containers. There is always a good demand for foods preserved in this way. The canning projects supplement the fruit and vegetable gardening work and make all profitable.

There are five general ways of canning food stuffs: the intermittent, or fractional-sterilization, method; cold-water method; vacuum-seal method; hot-pack, or open-kettle, method; and the cold-pack method.

The intermittent method is very effective, but requires three days to complete the process and is expensive in time and fuel. The cold-water method is used with sour food stuffs, such as gooseberries and rhubarb. The product is washed and sealed in cold water. In the vacuum-seal method a special can is required. It is successful, but has not yet come into general use.

The hot-pack, or open-kettle, method is still the common way of canning in most homes. The products are completely cooked before packing in the cans and sealing. The method is a success for fruits, but is a failure for vegetables, and it is always laborious.

The cold-pack method is gradually displacing the hot-pack. It is the method generally recommended for the club work and home canning projects. By it, vegetables, as well as fruits, may be preserved.

The equipment for canning by the cold-pack method need not be elaborate. While there are several kinds of commercial outfits on the market, their chief advantage over the homemade ones is their convenience. Homemade outfits may be constructed from washtubs, wash boilers, kettles, milk cans, pails, etc. Select an outfit that is deep enough for water to come one inch above the top of the tallest jar. This type of cooker is called a hot water bath outfit.

It should be provided with handles, a false bottom and a tight cover. The false bottom is used to keep the containers off the bottom and thus allow water to come in contact with the cans or jars. A tinner can make a special false bottom, or one can be made at home by fastening thin boards to some cleats and submerging in the water. Wire handles may be fastened to the false bottom to lift the entire lot of containers out when cooked, or the cans may be removed singly with tongs or other device.

Figure 110. Growing vegetables for the canning contest.

The various steps in cold-pack canning are, in order, as as follows: Select sound products; grade for ripeness, size and quality; wash clean; trim, if necessary; scald or iblanch to loosen the skin, reduce bulk and drive out objectionable acids; plunge into cold water immediately, or "cold dp," to separate the skin from the pulp, firm the texture, set the color and render packing easy; pack carefully and closely in glass jars or tin cans; add hot water for vegetables and hot water or hot syrup for fruits; place rubber and cover on jar

and partially seal, or cap and tip tin cans at once; cook, or "process," immediately and according to time-table, but do not begin to count time until the water in the cooker is boiling. Scalding is immersing for one or two minutes in boiling water or live steam. It is used mostly for tree fruits and tomatoes. Blanching is parboiling. The product is left in the boiling water for a longer period than is necessary for scalding. The time varies from one to fifteen minutes, according to the nature of the product.

The time necessary to cook the products will depend upon the kind of food stuff to be canned and the altitude. Water boils at 212°F. at sea level, but the boiling point decreases as the altitude increases. It takes longer, therefore, to cook the products at high altitudes. In general, the time should be increased at the rate of about 25 per cent for each increase of 4,000 feet in altitude. In general, the time required in the hot water bath outfit for soft fruits, such as berries, peaches, etc., at an altitude of 500 feet, is about 16 minutes; for sour berry fruits, such as currants, gooseberries, etc., about 16 minutes; for hard fruits, such as apples, pears, etc., 20 minutes; for greens, such as spinach, Swiss chard, etc., blanch 15 or 20 minutes and sterilize 90 minutes; for roots and tubers, such as parsnips, sweet potatoes, etc., 90 minutes; for tomatoes, 22 minutes; for sweet corn, 180 minutes; for string beans and peas, 120 minutes; and for pumpkin and squash, 60 minutes. While overcooking makes the product look mushy, it is always better to overcook than to undercook, as in the latter case the food is likely to spoil.

As soon as removed from the cooker, the glass containers should be tightly sealed, and placed bottom side up until cold. They should then be stored in a darkened place, as strong light fades the color.

The person or club doing the canning should send to the Department of Agriculture, Washington, D. C., for the N R series, "Co-operative Extension Work in Agriculture and Home Economics," for complete recipes, tables, etc., necessary for a thorough understanding of the subject. It is suggested that, where club work is done at school or at home, a commercial canning outfit should be purchased. It could belong to the club or to the school. Many clubs have worked on the co-operative plan and sold enough canned products from the home gardens to bring large returns for the time and money invested. Special labels for club work can be obtained and should be used for the cans that are to be sold. The club brand is popular in many markets.

POULTRY CONTEST

A poultry contest may be made one of the most interesting of the club projects. Poultry raising is light work and is often regarded as being especially suitable and profitable for boys. Select the breed you prefer and start with the best pure bred birds you can get. If you cannot afford to buy hens, buy a setting of eggs. In any event, start slowly

Figure 111. For pleasure and profit, pure bred poultry are preferable

until you get used to the business, for poultry raising will require more careful attention and management than almost any of the other club projects. If you like it and are successful, then launch out as extensively as you desire. You should purchase a good poultry book and study it carefully to supplement the school work and learn the science as well as the art. If by proper housing and feeding you can make a hen produce fifty eggs during the winter when the average hen does not lay, the value of the extra eggs at that time will represent your skill in managing the flock. Or, if the yearly production of the flock can be increased from 10 to 25 per cent by efficient management, which would not be a difficult matter with the average flock, it would mean the difference between a profit and a loss.

Poultry raising is one of the important industries of the country, over twenty million eggs being produced annually. If you do not have a separate house for the flock, provide the best place that you can. Do not overcrowd. Fifty fowls are sufficient for one room of 300 square feet, floor space. Keep the floor, roosts and nests clean, and the poultry will be free from vermin. See that there is plenty of fresh air and they will not likely be sick. Feeding is the most difficult part of the whole business for the beginner. Study this phase until you understand what is meant by a balanced ration and work out one or more for your poultry. Do not overlook the grit and shells, green feeds and meat scraps during the winter months. Gather the eggs daily, keep them clean and grade them before marketing. As this topic is discussed in detail by the author in "Industrial Booklets," a companion volume, it is not necessary to give more information here.

The following ration from Cromwell's "Agriculture and Life" was worked out by a young lady interested in poultry.

It was the cheapest balanced ration she could find for 100 Plymouth Rock hens and is an excellent one:

Balanced Ration for Laying Hens

Feed	Digestible Dry Matter	Protein	Carbohydrates	Cost
Wheat, 8 pounds	7.16	.70	5.66	$ .15
Corn, 15 pounds	12.75	1.01	10.83	.15
Oats, 4 pounds	3.58	.43	2.35	.06
Milk, 30 pounds	2.82	.87	1.77	.06
Meat scraps, 1½ pounds	1.34	.90	.47	.03
	27.65	3.91	23.08	$ .45
Standard for balanced ration	27	4	24	

The digestible dry matter and protein in this ration are very close to the standard for a balanced ration, while the carbohydrates are a little under. Try this on your hens and see if you can feed them for less than a half cent each a day. Work out other rations of your own and present them for class study. When a hen is hatched from the shell, she has within her body the embryos of all the eggs she can ever lay. It is the business of the scientific poultry raiser to get the greatest number of these embryo eggs to develop and be laid during the first year of laying, as hens are seldom profitable after the first year and should never be kept longer than two years. Heredity has a great deal to do with early laying and that is why it pays to raise pure bred stock. Proper feeding and housing, however, probably have more to do with rapid egg production than heredity.

PIG CONTEST

Among the most interesting projects of the club work is the pig contest. The county is frequently the unit of territory for this project and both boys and girls enter the contest. The object is to encourage the raising of pure bred stock and to teach the principles of stock raising. For

information on conducting a pig contest consult the state experiment station or a county agent.

In one county in which the work was conducted by the county agent, or agricultural director, the local bankers supplied the capital for the contest. The Duroc-Jersey breed was decided upon and pure bred stock distributed to the boys and girls in the contest. The hogs were sold to the contestants at cost, most of the latter giving their notes without interest until the close of the contest in the fall. Definite rules were followed for feeding, care, weighing, etc., and the Fourth of July was announced as the date for all contestants to take the brood sows and litters to the county seat for preliminary judging. A great deal of interest was shown by the people of the community at this time. The winners at the preliminary contest entered the final contest in the fall. The contest was so successful that the same set of business men offered to finance a similar contest for pure bred dairy cattle.

SAVINGS BANKS

One of the best plans to encourage thrift and to teach the value of saving is the one now adopted by many schools of affiliating the school with one or more banks and allowing students to make weekly deposits. The teacher acts as local cashier and deposits the money at the banks when convenient. One day a week is known as banking day at school and pupils may deposit any amount from one cent up. They are given stamps as certificates. These stamps are furnished free by the banks. One school of thirty students recently deposited more than $100 in four months, most of which would have been spent needlessly, had they not become interested in the savings bank movement. The garden and club work make it possible for all young persons

to earn money for themselves and there is all the more need of learning to save. Many look upon "pin" money as something with which to buy chewing gum and candy, if not something more injurious. Increasing the earning capacity is very important, but unless one learns to spend less than is earned, there can be no saving. The following ten thrift maxims have been selected from an Oregon pamphlet on "Industrial Club Work." They are proverbs well worth considering.

"Fortune helps them that help themselves."

"Punctuality is the soul of business."

"Who will not keep a penny shall never have many."

"Plow deep while sluggards sleep, and you shall have corn to sell and keep."

"Industry is fortune's right hand and frugality her left."

"He is poor whose expenses exceed his income."

"Early to bed, early to rise, makes a man healthy, wealthy and wise."

"He that will not stoop for a pin will never be worth a pound."

"He that has but four, and spends five, has no need of a purse."

"He that saves when he is young may spend when he is old."

KEEPING ACCOUNTS

As a supplement to the contest work and savings bank deposits, it is necessary to keep accounts. Not only is a knowledge of accounts advisable, but students should learn that no business can be done successfully without accounts. It is the unsystematic and unbusinesslike way in which most farming has been done that led to the belief that those who cannot do anything else can farm. Modern farming is a

highly complicated business and those who are capable of managing it as such will be most successful.

Accounts should not be difficult to any boy who can do ordinary sixth grade arithmetic. There are a few simple things that must be remembered and always followed. An account is the name under which certain transactions are arranged according to whether they have been "received" or "parted with." When an account receives something, the transaction is put on the left side, or "debited;" when it parts with something, the transaction is put on the right side of the account, or "credited." For example, in the acre-yield corn contest two accounts must be kept, one for "Corn" and one for "Cash." If you pay out cash for seed or labor or any other expense of raising the corn, you would credit "Cash," as that account parted with something. You would also debit "Corn," as that account received the same amount. In like manner you would debit "Corn" for the value of all the labor of preparing the ground, seeding, cultivating and harvesting, and you would credit the same account for all corn fed or sold from your acre. If you received cash for part or all of it, that amount would be debited to the "Cash" account. Have a record sheet to keep the number of hours of horse labor as well as of your own, as all labor must be paid for in determining the cost of production. From this the general principles of accounts, or bookkeeping, can be seen.

Usually, accounts are kept by the "double entry" method; that is, the same amount that is debited to one account is credited to another account as illustrated above. Much of what used to be kept in the Day Book and Journal is now posted directly to the Ledger account, and card systems have taken place of the books to a large extent. Special record sheets for labor, milk and egg records, etc., can be

secured free from the nearest state experiment station, and all you will need is a ledger or some ledger ruled sheets or cards which you can rule yourself. The school could have these cards made six by eight inches and ruled at a very small cost, if done by the thousand. The accounts here suggested are for the farm, but it should be remembered that the principles are the same for any business and, hence, they can be applied to the store or business office as well.

A modern department store is a good example of the necessity of keeping accounts for each department instead of for only the business as a whole. The dry goods department may make money and the grocery department lose, or the drug department may show a profit while the meat department shows a loss at the end of the year. The general manager will then know that the grocery and meat departments are a detriment to the business and the managers of these departments will be called in consultation. Better methods must be adopted and these departments made to show a profit or they will be discontinued.

A farmer may keep enough records to know that his farm has been managed profitably rather than at a loss; but, unless he keeps accounts for each department of his business, he does not know which ones have been most profitable. The hogs may produce a profit only to be "eaten up" by the "star boarders" in the dairy herd, and the corn and hay may barely offset the loss on the wheat or other grain fields. Accounts for each of his "departments" will enable the farmer to send his poor cows to the butcher, to increase the live stock and crops that pay best and to improve the weak parts of his business or discontinue them altogether. It is the ability to keep such accounts and the foresight to see that it is worth while to do it that makes some farmers business men while others are not.

Every boy should supplement his school work in arithmetic and accounts by keeping the records of one or more departments of the farm or other business. These accounts should be checked up by the teacher and credit given when completed. Study the suggestive farm accounts here given and start some of your own as soon as you have done enough of the work in school to do it correctly. Remember that accuracy is the first requisite to success in account keeping, and neatness and rapidity come next.

The inventory is the first step in farm accounts. What is known as a continued inventory is commonly kept as it contains space for the list of things on hand for more than one year. Some time between January 1 and April 1 is the best time to take "stock" on the farm, as there is less produce to be listed then than at any other time of the year. It is not a busy season either and is, therefore, a good time to make out the annual statement. This statement is made from the accounts and inventory and shows the gain or loss on the year's business as well as the net present worth. The inventory is merely a list of the farm implements, live stock, produce on hand and any other items of value on the place. Sometimes a statement is combined with the inventory as shown in the suggestive inventory. The items shown in the inventory are "Resources." Any notes to be paid or other obligations to be met are "Liabilities." Subtracting the liabilities from the resources will give the "Present Worth." The present worth is usually shown in the proprietor's account; but, if no accounts are kept, an inventory may be made to show this in a general way, and a farmer who can be pursuaded to keep an inventory will usually start the accounts later.

In addition to the inventory the following accounts are suggested for the farm: Cash, Dairy or Live Stock, if the

dairy is not of sufficient importance to have a separate account, Hogs, Corn, Small Grains and what personal accounts are necessary. We shall suppose that a personal account is kept with the Hinckley Implement Company. As already intimated, the feed and labor records should be kept on special cards for that purpose. The improvements, depreciation and machinery and implements accounts can all be shown in the inventory.

Suggestive Inventories and Accounts

CONTINUED INVENTORIES

Items	Remarks	Apr. 1, 1916	Apr. 1, 1917	Apr. 1, 1918
Farm and Buildings..	*160 Acres*	*$12,000.00*	*$12,320.00*	
Corn (Seed)	Market value	30.00	40.00	
Corn (Feed)	Market value	120.00	135.00	
Oats (Feed)	Market value	110.00	120.00	
Wheat (Seed)	Market value	30.00	36.00	
Wheat (Sale)	Market value	125.00	135.00	
Hay (Feed)	Market value	215.00	250.00	
Vegetables	Market value	25.00	27.00	
	Total Produce	*655.00*	*743.00*	
Horses	Market value	650.00	530.00	
Cows and Calves	Market value	1,250.00	1,375.00	
Steers	Market value	235.00	225.00	
Hogs	Brood Sows	250.00	280.00	
Sheep	Ewes	125.00	140.00	
	Total Stock	*2,510.00*	*2,550.00*	
Poultry	General purpose	65.00	75.00	
Mach. and Implemt's	Less 10% depreciat'n	625.00	562.50	
General Supplies		25.00	27.50	
Cash	Subject to check	125.00	187.17	
	Miscellaneous	*840.00*	*852.17*	
Total Resources		*16,005.00*	*16,465.17*	
Labor	Unpaid	72.00	36.00	
Personal Accounts	Unpaid	125.15	74.18	
Bills Payable	Notes out	2,000.00	1,500.00	
Total Liabilities		*2,197.15*	*1,610.18*	
Net Present Worth		*$13,807.85*	*$14,854.99*	

CASH

Date	Brought Forward	$125.00	Date	Brought Forward	
4/6	30 bu. wheat @ $1.10	33.00	4/8	1 keg nails	$ 5.25
4/24	2 hogs @ $20	40.00	4/21	100 gal. gasoline	11.00
5/11	3 steers @ $65	195.00	5/12	100 ft. lumber	6.50
5/28	2 calves @ $10	20.00	6/22	Fence supplies	68.75
6/10	1 calf (Pure bred)	75.00	7/1	House allow. (3 mo.)	90.00
7/20	75 bu. wheat @ $1.03	77.25	7/22	Machinery repairs	13.65
			7/31	*Balance on hand*	*370.10*
		$565.25			*$565.25*
7/31	Bal. on hand	$370.10			

HINCKLEY IMPLEMENT CO.

Date	Brought Forward		Date	Brought Forward	$ 35.40
4/1	By check No. 320	$ 75.00	4/1	1 manure spreader	$120.00
6/25	By check No. 374	50.00	6/20	1 corn cultivator	32.00
11/18	By check No. 463	127.40	9/15	1 gang plow	65.00
		$252.40			*$252.40*

CORN

Date	Brought Forward		Date	Brought Forward	
4/1	Val. 30 acres @ $75	$ 2250.00	10/1	Value land (same)	$2,250.00
	Int. on invest. @ 6%	135.00	.....	1500 bu. corn @ $.60	900.00
	Seed, 4 bu. @ $2.50	10.00	.....	Value corn fodder	60.00
	Value manure	90.00	.....		
10/1	Labor and twine	315.00			
	Depre. and int. mach.	15.00			
	Incidentals	4.75			
	Net Gain	*390.25*			
		$3,210.10			*$3,210.00*

SMALL GRAIN

Date	Brought Forward		Date	Brought Forward	
4/1	Val. 60 acres @ $75	$4,500.00	9/1	Value land (same)	$4,500.00
	Int. on invest. @ 6%	270.00		1200 bu. oats @ $.40	480.00
	Seed grain	75.00		540 bu. wheat @ $.90	486.00
	Val. manure	180.00		Value of straw	60.00
9/1	Labor and twine	188.00			
	Threshing	75.00			
	Depre. and int. mach.	20.00			
	Incidentals	5.25			
	Marketing	15.00			
	Net Gain	*197.75*			
		$5,526.00			*$5,526.00*

DAIRY

Date	Brought Forward		Date	Brought Forward	
4/1	20 cows @ $60	$1,200.00	4/1	18 cows @ $56	$1,008.00
	Int. on invest. @ 6%	72.00		Sold 2 cows @ $48	96.00
	Grain fed	480.00		15 calves @ $5	75.00
	Roughage fed	300.00		Skimmed milk for hogs	180.00
	Pasturage	100.00		5400 lbs. butter fat @ $ .28	1,512.00
	Labor	240.00			
	Cost of shelter	48.00			
	Miscellaneous	9.25			
	Net Gain	*421.75*			
		$2,871.00			*$2,871.00*

HOGS

Date	Brought Forward		Date	Brought Forward	
4/1	10 sows @ $25	$ 250.00	4/1	10 sows at $22.50	$ 225.00
	Int. on invest. @ 6%	15.00		80 hogs,20,000 lbs.@7c	1,400.00
	Grain fed	540.00			
	Other feed	320.00			
	Labor	80.00			
	Cost of shelter	24.00			
	Net Gain	*396.00*			
		$1,625.00			*$1,625.00*

INDUSTRIAL EXHIBIT

Finally, as the grand climax of your industrial work, plan to have at least one industrial exhibit each year at the school and invite all the people of the community. Get the farmers' club, the creamery directors and other organizations, as well as the school board, interested enough to offer small prizes to encourage the work. If no prizes are offered, have the exhibit anyway. The best plan is to have two—one in the spring just before school is out, and the other in the fall just before cold weather. In the spring, the best work of the year at school may be shown, not only the industrial work, but arithmetic, writing, language, etc. A spelling contest will add interest. In the fall, a "harvest home festival" may be given at which will be exhibited the work done by the students during the summer. This will include garden products, corn, tomatoes, canning and other contest work, as well as any other special "home credit" projects.

Premium List for Contest in Associated Schools

PENMANSHIP

1.	Best individual specimen of writing, including movement exercises, small letters, capitals, figures and words	.75	.50	.25
2.	Best general display from all grades	.75	.50	.25

GEOGRAPHY

1.	Best relief map of Minnesota	.75	.50	.25
2.	Best relief map of any continent	.75	.50	.25
3.	Best drawn map of any kind,	.75	.50	.25

LANGUAGE

1.	Best booklet on any one of the following topics: Corn, Noxious Weeds, Vegetable Garden, Strawberries, Apples, Poultry for Pleasure and Profit, Farm Animals, Bee Culture, Home Sanitation, The Typhoid Fly	.75	.50	.25
2.	Best general display from all grades	.75	.50	.25

ARITHMETIC

1.	Best general display from all grades	.75	.50	.25

ELEMENTARY INDUSTRIAL WORK

1.	Best woven mat, yarn or cloth	.75	.50	.25
2.	Best hammock	.75	.50	.25
3.	Best napkin ring	.75	.50	.25
4.	Best raffia or reed mat	.75	.50	.25
5.	Best raffia or reed basket	.75	.50	.25
6.	Best yarn cap or bonnet	.75	.50	.25
7.	Best clay exhibit	.75	.50	.25
8.	Best general exhibit of industrial work	.75	.50	.25

SEWING

1.	Best needlebook	.50	.35	.25
2.	Best outing flannel holder	.50	.35	.25
3.	Best gingham holder	.50	.35	.25
4.	Best sleevelets	.50	.35	.25
5.	Best cap	.50	.35	.25
6.	Best hemstitched towel	.75	.50	.25
7.	Best stockinet darning	.75	.50	.25
8.	Best buttonholes	.75	.50	.25
9.	Best gingham bag	.75	.50	.25
10.	Best sewing apron	.75	.50	.25
11.	Best hemmed patch	.75	.50	.25
12.	Best three-cornered darn	.75	.50	.25
13.	Best outing flannel nightgown	.75	.50	.25
14.	Best overhand patch	.75	.50	.25
15.	Best general exhibit of sewing. Each article is to be made as directed in course of study			

MANUAL TRAINING

1.	Best match scratcher	.50	.35	.25	
2.	Best plant marker	.50	.35	.25	
3.	Best salt box	.75	.50	.25	
4.	Best match box	.75	.50	.25	
5.	Best other article	.75	.50	.25	
6.	Best composition on "Manual Training in the Rural School"	.75	.50	.25	
7.	Best general exhibit in manual training				1.00

AGRICULTURE

1.	Corn judging contest	.75	.50	.25	
2.	Corn germinator with germinating corn ready to count. Must include report on test and opinion of seed by exhibitor	.75	.50	.25	
3.	Long and short splice (both must be included)	.75	.50	.25	
4.	Best general exhibit of rope work including knots and splices	.75	.50	.25	
5.	Best noxious weed seed exhibit to be selected and determined by the school	.75	.50	.25	
6.	Best general exhibit in agricultural work				1.00

The greatest need of the nation in the immediate future is a generation of young men who are physically and morally strong, alive to their opportunities, industrious, thrifty, impressed with the dignity of labor and trained with a practical education that will enable them to "make good."

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AND
MARIE C. HENEGREN

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CONTENTS

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